9.3.3 2035 Conditions (No-Build vs. Build)

9.3.3.1 Travel Demand Differences

AM Peak

Table 9-26 is a summary of the projected demand for the 2035 AM peak hour for both No-Build and Build scenarios at key screen line locations in the network. The demand across all lanes (GP and HOV/HOT lanes combined) in the peak northbound direction is projected to be between three and 23 percent higher in the Build scenario than the No-Build scenario, depending on the location within the corridor. Every screen line location will have an increase in 2035 demand for the Build scenario, which is due to the increased capacity of the HOV/HOT lane facility. The increase in capacity causes shifts in travel demand along the I-95 corridor from either other alternative routes in the area or from other adjacent time periods within the AM peak period. Just outside of the project limits, the increase in demand is expected to be much lower. For example, demand south of the Jefferson Davis Highway Interchange expected to be four percent higher in the Build scenario. North of the Duke Street interchange, demand is expected to be three percent higher in the Build scenario.

Table 9-26: 2035 AM Peak Hour No-Build and Build Demand – Northbound Direction

Screenline Location	Demand Volumes (Vehicles/hour)						Abs Diff Overall	% Diff Overall
	2035 No Build AM			2035 Build AM				
	GP	HOV	Overall	GP	HOT/HOV	Overall		
South of Garrisonville Rd	6487	0	6487	5446	2022	7468	981	15%
Between Garrisonville Rd & Russell Rd	7205	0	7205	5308	2463	7771	566	8%
Between Russell Rd & Joplin Rd	6095	0	6095	4879	2259	7138	1043	17%
Between Joplin Rd & Dumfries Rd	6236	0	6236	5066	2259	7325	1089	17%
Between Dumfries Rd & Opitz Blvd	5114	1180	6294	4662	2752	7414	1120	18%
Between Opitz Blvd & PWP	5252	1765	7017	4844	3540	8384	1367	19%
Between PWP & Gordon Blvd	5629	2615	8244	5874	3877	9751	1507	18%
Between Gordon Blvd & Richmond Hwy	7007	3157	10164	7233	4750	11983	1819	18%
Between Richmond Hwy & Lorton Rd	6916	3306	10222	7208	5255	12463	2241	22%
Between Lorton Rd & FCP	7619	3406	11025	8089	5496	13585	2560	23%
Between FCP & Franconia Rd	7378	2752	10130	7609	3694	11303	1173	12%
Between Springfield IC & Edsall Rd	6718	2922	9640	6244	4025	10269	629	7%
Between Edsall Rd & Duke St	6010	3152	9162	6374	3258	9632	470	5%
North of Duke St	6599	3152	9751	6772	3258	10030	279	3%
							Average	**14%**

As shown in Table 9-26, between Duke Street and Springfield Interchange, the increase in demand ranges from three to seven percent. The highest demand increase in the corridor occurs between Richmond Highway and Fairfax County Parkway ranging between 22 and 23 percent. Along the peak northbound direction of I-95, the increase in demand in the Build scenario is expected to occur in the HOV/HOT lanes, while demand on the GP lanes fluctuates depending on location but it is generally lower in the Build scenario. The GP lane demand variation ranges from a decrease of approximately 26 percent near Russell Road to an increase of approximately six percent between Lorton Road and Fairfax County Parkway. Demand in the HOV/HOT lanes for the Build scenario is significantly higher than in the No-Build scenario, ranging from 38 to 133 percent higher between Dumfries Road and the I-495 Springfield interchange.

Along the I-495 Beltway, demand is generally similar between the No-Build and Build scenarios.

PM Peak

Table 9-27 is a summary of projected demand for the 2035 PM peak hour for both No-Build and Build scenarios at key screen line locations in the network. The demand across all lanes (GP and HOV/HOT lanes combined) in the peak southbound direction is projected to be between four and 19 percent higher in the Build scenario than the No-Build scenario, depending on the location within the corridor. Every screen line location will have an increase in 2035 demand for the Build scenario, which is due to the increased capacity of the HOV/HOT lane facility. The increase in capacity causes shifts in travel demand along the I-95 corridor from either other alternative routes in the area or from other adjacent time periods within the PM peak period. Just outside of the project limits, the increase in demand is expected to be much lower. For example, demand south of the Jefferson Davis Highway Interchange expected to be eight percent higher in the Build scenario. North of the Duke Street interchange, demand is expected to be four percent higher in the Build scenario.

Table 9-27: 2035 PM Peak Hour No-Build and Build Demand – Southbound Direction

Screenline Location	Demand Volumes (Vehicles/hour)						Abs Diff Overall	% Diff Overall
	2035 No Build PM			2035 Build PM				
	GP	HOV	Overall	GP	HOT/HOV	Overall		
North of Duke St	7810	2701	10511	7686	3292	10978	467	4%
Between Duke St & Edsall Rd	6730	2701	9431	6987	3292	10279	848	9%
Between Edsall Rd & Springfield IC	6745	2558	9303	6361	4385	10746	1443	16%
Between Franconia Rd & FCP	7580	2861	10441	7634	3541	11175	734	7%
Between FCP & Lorton Rd	7580	3415	10995	7178	5161	12339	1344	12%
Between Lorton Rd & Richmond Hwy	7033	3363	10396	6836	5161	11997	1601	15%
Between Richmond Hwy & Gordon Blvd	7973	3314	11287	7600	4953	12553	1266	11%
Between Gordon Blvd & PWP	7847	2992	10839	7395	4370	11765	926	9%
Between PWP & Opitz Blvd	7063	1952	9015	6859	2708	9567	552	6%
Between Opitz Blvd & Dumfries Rd	5635	1460	7095	5562	2463	8025	930	13%
Between Dumfries Rd & Joplin Rd	6759	0	6759	5311	2204	7515	756	11%
Between Joplin Rd & Russell Rd	6344	0	6344	4788	2752	7540	1196	19%
Between Russell Rd & Garrisonville Rd	7608	0	7608	5909	2752	8661	1053	14%
South of Garrisonville Rd	7298	0	7298	6618	1850	8468	1170	16%
							Average	**12%**

As shown in Table 9-27, between Duke Street and Springfield Interchange, the increase in demand ranges from nine to 16 percent. The highest demand increase in the corridor occurs between Joplin Road and Garrisonville Road ranging between 13 and 19 percent. Along the peak southbound direction of I-95, the increase in demand in the Build scenario is expected to occur in the HOV/HOT lanes, while demand on the GP lanes fluctuates depending on location but it is generally lower in the Build scenario. GP lane demand variation ranges from a decrease of approximately 25 percent near Russell Road to an increase of approximately four percent between Franconia Duke Street and Edsall Rd. Demand in the HOV/HOT lanes for the Build scenario is significantly higher than in the No-Build scenario, ranging from 12 to 71 percent higher.

Along the I-495 Beltway, demand is generally similar between the No-Build and Build scenarios.

9.3.3.2 Travel Time Analysis

AM Peak

Table 9-28 and **Exhibit 9-20** compare travel times between free flow, existing, 2035 No-Build, and 2035 Build conditions in the AM peak hour. Travel time measures have been aggregated by direction of travel, and type of facility (GP and HOV/HOT lanes). The travel time summary is based on the following segment delineations:

- From Garrisonville Road to Dale Boulevard
- From Dale Boulevard to Fairfax County Parkway
- From Fairfax County Parkway to I-495 Capital Beltway (Springfield Interchange)
- From I-495 Capital Beltway to I-395 Duke Street

Table 9-28: Travel Times Summary for Existing and 2035 AM Peak-hour No-Build and Build scenarios

Travel Times Summary Table					
	Travel Time (minutes)	Free Flow Travel Time	Existing AM	2035 No Build AM	2035 Build AM
Northbound GP Lanes	I-95 Garrisonville to Dale Boulevard	12.4	14.2	13.1	13.1
	I-95 Dale Boulevard to Fairfax Co. Parkway	10.0	18.5	12.2	12.5
	I-95 Fairfax Co. Parkway to Springfield IC	3.5	6.2	4.0	4.1
	I-95 Springfield to I-395 Duke Street	2.6	10.5	9.2	9.4
	Total Northbound Mainline	***28.4***	***49.4***	***38.5***	***39.0***
Southbound GP Lanes	I-395 Duke Street to I-95 Springfield	2.6	2.6	2.6	2.6
	I-95 Springfield to I-95 Fairfax Co. Parkway	3.4	3.4	3.5	3.4
	I-95 Fairfax Co Parkway to Dale Boulevard	9.3	9.4	9.3	9.4
	I-95 Dale Boulevard to Garrisonville	11.6	12.0	11.6	11.6
	Total Southbound Mainline	***26.8***	***27.4***	***27.0***	***27.0***
Northbound HOV/HOT Lanes	I-95 Garrisonville to Dale Boulevard	12.0	13.7	12.6	12.4
	I-95 Dale Boulevard to Fairfax Co. Parkway	8.7	9.3	9.3	9.1
	I-95 Fairfax Co. Parkway to Springfield IC	3.0	3.2	3.2	3.3
	I-95 Springfield to I-395 Duke Street	2.3	2.4	2.4	2.4
	Total Northbound HOV/HOT lane facility	***26.0***	***28.6***	***27.5***	***27.2***

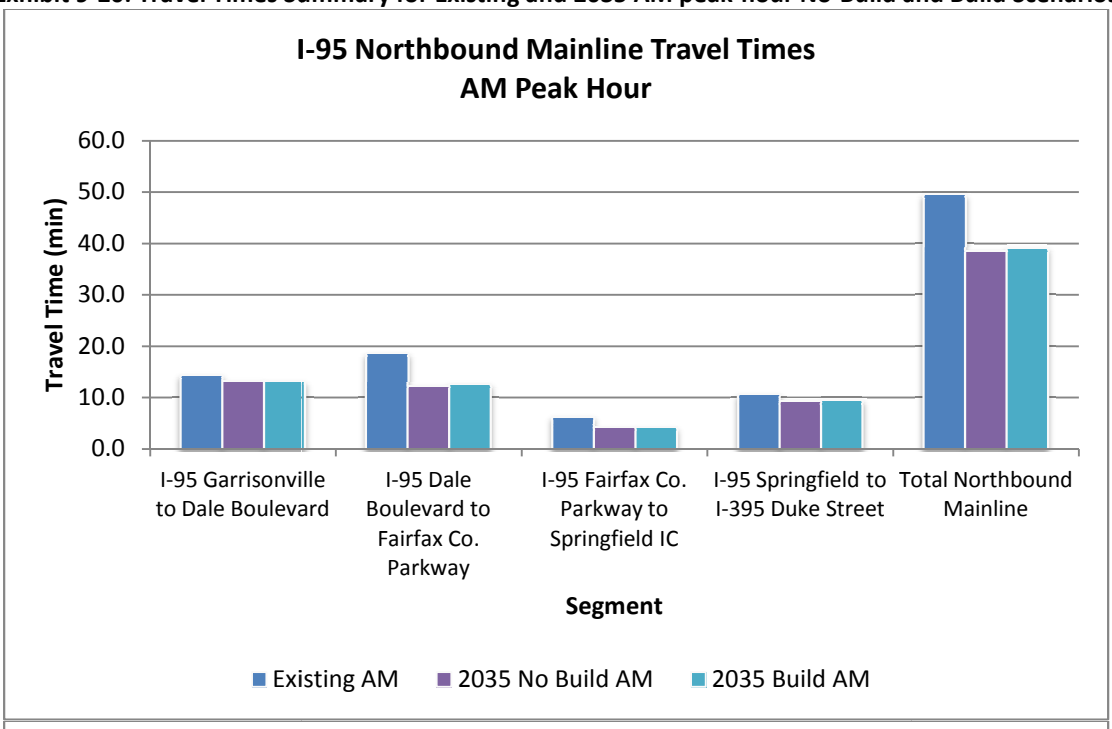
NOTE:

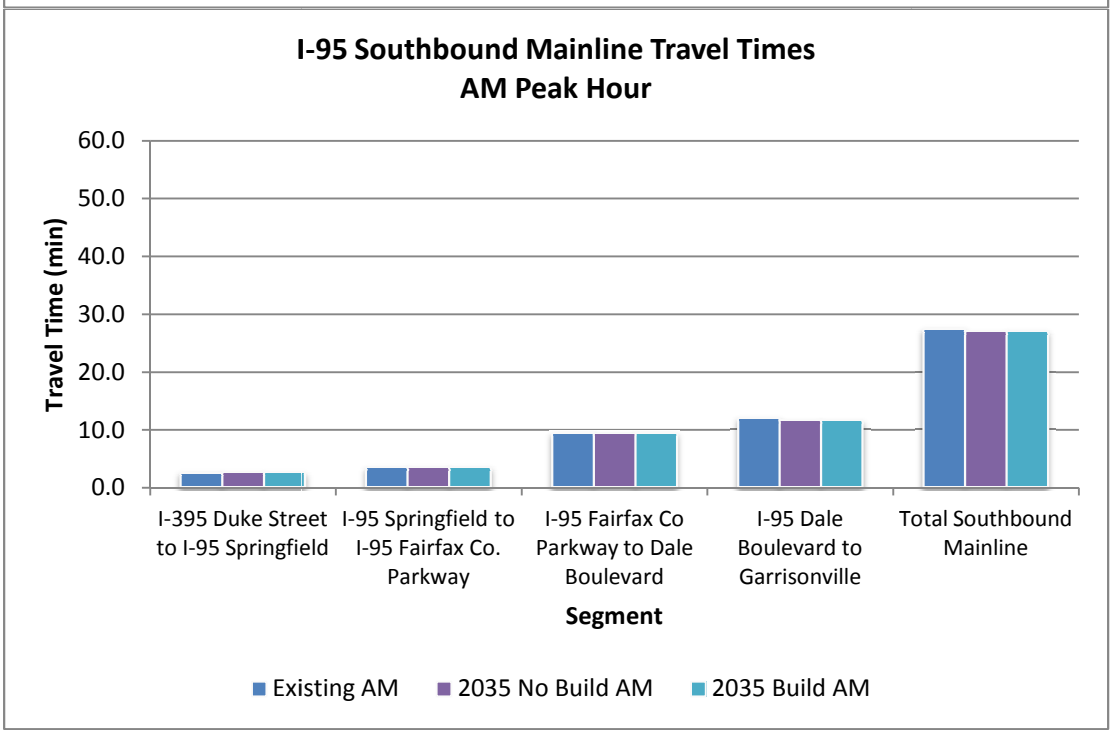
Highlighted cells indicate segments where the HOV/HOT lane facility does not exist; therefore GP travel times are used.

Travel times for the entire corridor are very similar in the northbound GP lanes for the 2035 No-Build and Build scenarios during the AM peak hour. Both the 2035 No Build and Build scenarios have lower projected travel times than the Existing scenario (between 10 and 11 minutes lower), due to several planned capacity projects including the fourth lane widening between Gordon Boulevard and Richmond Highway and the Fairfax County Parkway interchange improvements. In both the 2035 No-Build and Build scenarios, northbound GP drivers take an average of approximately 39 minutes to traverse the entire corridor from Garrisonville Road to Duke Street. In the off-peak (southbound) direction, the travel time is approximately 27 minutes between Duke Street to Garrisonville Road for Existing, 2035 No-Build, and 2035 Build.

There is no projected travel time savings in the peak (northbound) direction GP lanes for the Build scenario when compared to the No-Build scenario. Travel times in the HOT/HOT lanes are projected to take 27 to 28 minutes for both 2035 No-Build and Build scenarios, which results in a travel time savings of approximately 12 minutes when compared to the GP lanes.

Exhibit 9-20: Travel Times Summary for Existing and 2035 AM peak-hour No-Build and Build Scenarios





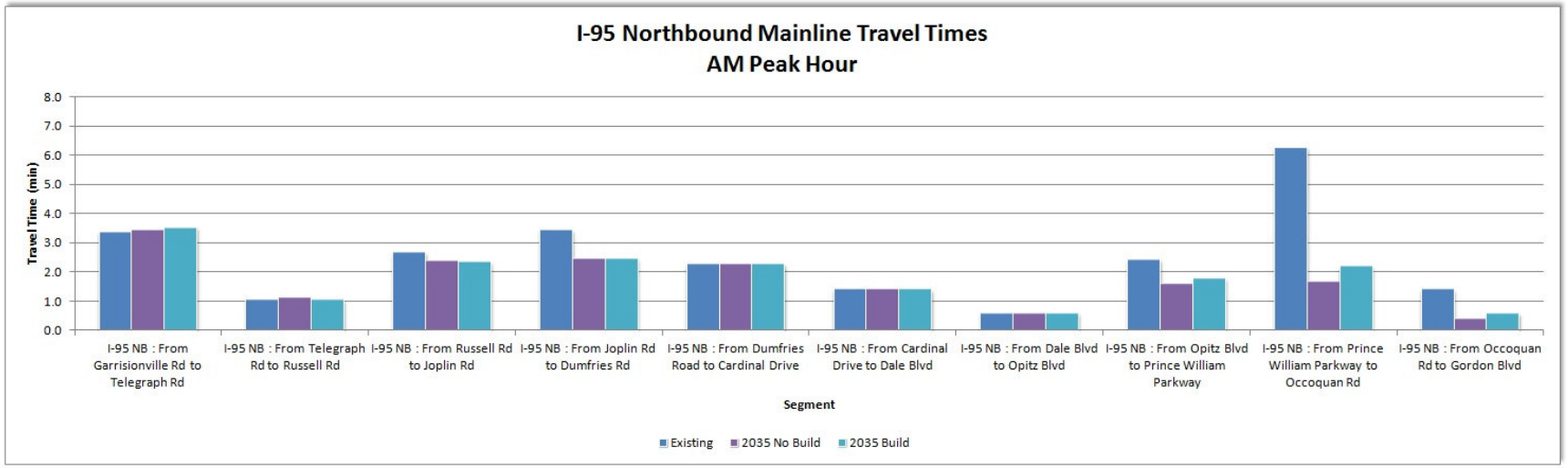
The northbound GP lane segments between Dale Boulevard and Fairfax County Parkway and between I-495 Springfield and I-395 Duke Street are projected to have minor increases in travel time for the 2035 Build scenario when compared to the 2035 No Build scenario. A more detailed review reveals that the increase in travel time is due to higher traffic demand on the GP lanes for both of these segments.

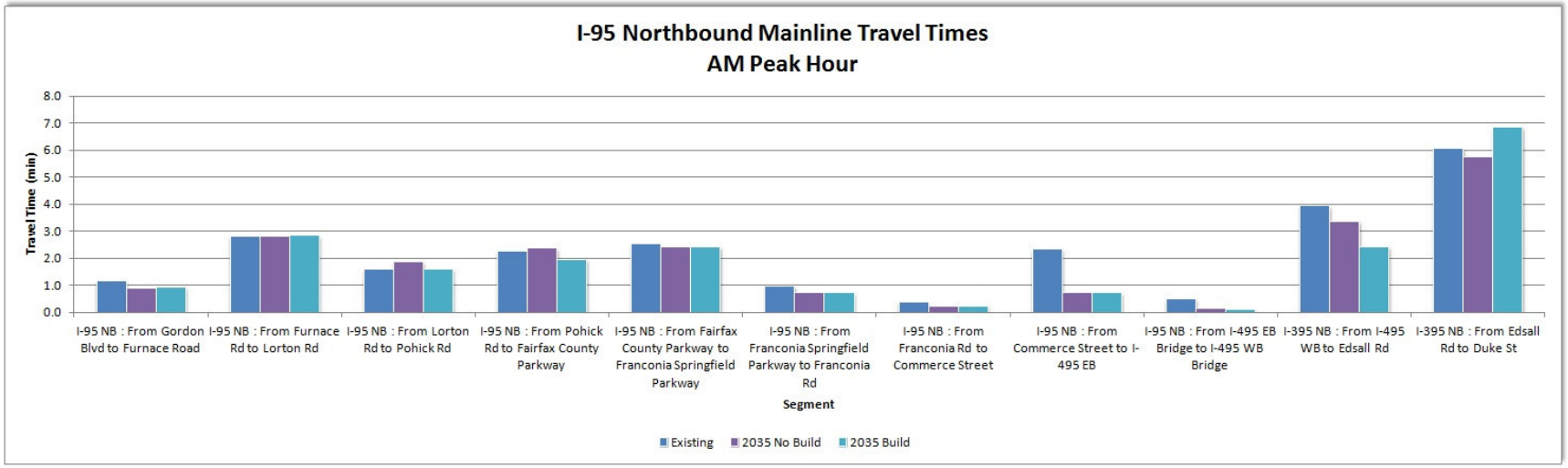
Exhibit 9-21 depicts the 2035 No-Build and 2035 Build travel times along the I-95 GP lanes for each freeway segment measured between adjacent interchanges in the southbound direction during the AM peak hour. As shown in this figure, most segments are projected to have similar travel times in Existing, 2035 No-Build, and 2035 Build conditions with the following exceptions:

- I-95 GP lanes from Prince William Parkway to Gordon Boulevard - The Fourth Lane Widening project between Gordon Boulevard and Richmond Highway reduces the travel time for both 2035 No-Build and Build scenarios compared to Existing.
- I-95 GP lanes from Commerce Street to Edsall Road - These segments show a reduction in travel time for both the No-Build and Build scenarios compared to Existing conditions. In the Existing scenario, queues originating from outside the corridor north of Duke Street spill back onto the I-95 GP lanes through the I-495 Springfield interchange as far south as Commerce Street. However, travel patterns are projected to change in the 2035 No-Build and Build scenarios, with a higher proportion of trips destined north on I-395 originating from the I-495 Beltway. This change in travel patterns leads to shorter travel time on the I-95 GP lanes and longer travel time on the I-495 ramps.
- I-95 GP lanes from Edsall Road to Duke Street - This segment shows an increase in travel time with the 2035 Build scenario when compared to the 2035 No-Build scenario. This is due to slightly higher GP lane demand in the 2035 Build scenario.

In conclusion, the overall travel time for the entire corridor is very similar for the 2035 No-Build and Build scenarios in both the GP lanes and HOV/HOT lanes. Both 2035 No-Build and Build experience lower travel times for the peak northbound direction GP lanes compared to Existing because of planned capacity improvements within the study area.

Exhibit 9-21: Existing, 2035 No-Build, and 2035 Build Travel Times – AM Peak – GP Lanes - Northbound Direction





PM Peak

Table 9-29 and **Exhibit 9-22** compare travel times between free flow, existing, 2035 No-Build, and 2035 Build conditions in the PM peak hour. Travel time measures have been aggregated by direction of travel, and type of facility (GP and HOV/HOT lanes). The travel time summary is based on the following segment delineations:

- From Garrisonville Road to Dale Boulevard
- From Dale Boulevard to Fairfax County Parkway
- From Fairfax County Parkway to I-495 Capital Beltway (Springfield Interchange)
- From I-495 Capital Beltway to I-395 Duke Street

Table 9-29: Travel Times Summary for 2035 PM Peak Hour Build and No-Build scenarios

	Travel Time (minutes)	Free Flow Travel Time	Existing PM	2035 No Build PM	2035 Build PM
Northbound GP	I-95 Garrisonville to Dale Boulevard	*12.4*	12.8	13.1	13.0
	I-95 Dale Boulevard to Fairfax Co. Parkway	*10.0*	10.3	10.3	10.3
	I-95 Fairfax Co. Parkway to Springfield IC	*3.5*	3.6	3.6	3.7
	I-95 Springfield to I-395 Duke Street	*2.6*	2.7	2.7	2.7
Southbound GP	***Total Northbound GP Lanes***	***28.4***	*29.3*	*29.6*	*29.7*
	I-395 Duke Street to I-95 Springfield	*2.6*	3.6	6.6	6.4
	I-95 Springfield to I-95 Fairfax Co. Parkway	*3.4*	3.7	3.7	3.8
	I-95 Fairfax Co Parkway to Dale Boulevard	*9.3*	25.7	22.3	20.5
	I-95 Dale Boulevard to Garrisonville	*11.6*	24.6	22.3	14.4
Southbound HOT/HOV	***Total Southbound GP Lanes***	***26.8***	*57.7*	*54.9*	*45.1*
	I-395 Duke Street to I-95 Springfield	*1.7*	1.7	1.9	1.7
	I-95 Springfield to I-95 Fairfax Co. Parkway	*3.3*	3.4	4.3	3.4
	I-95 Fairfax Co Parkway to Dale Boulevard	*9.5*	9.7	9.7	9.7
	I-95 Dale Boulevard to Garrisonville	*12.0*	22.6	22.0	12.3
	Total Southbound HOT/HOV Lanes	***26.5***	***37.4***	***37.9***	***27.1***

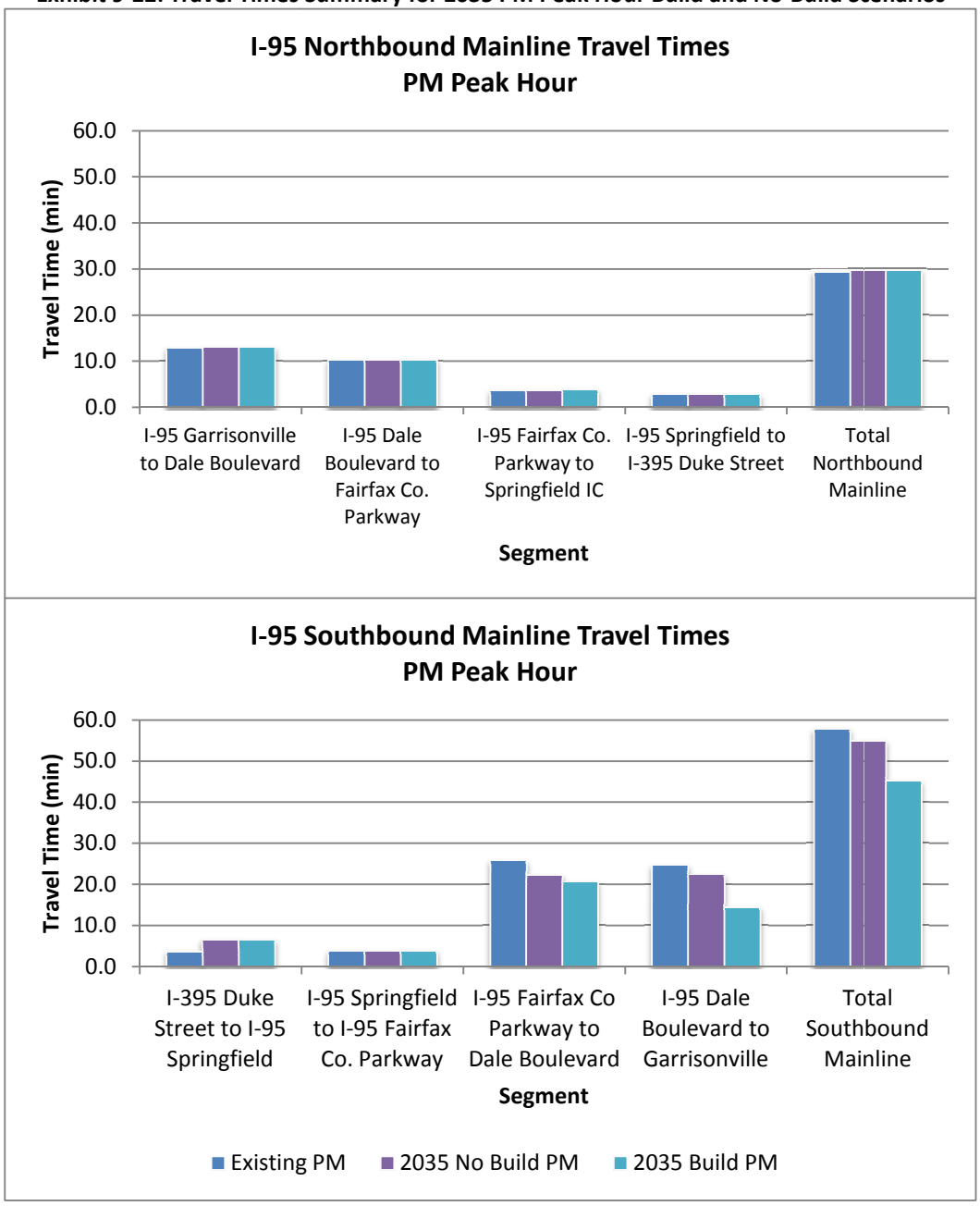
NOTE:

Highlighted cells indicate segments where the HOV/HOT lane facility does not exist, therefore GP travel times are used.

Travel times for the entire corridor are very similar for the Existing and 2035 No-Build scenarios during the PM peak hour. The travel time results are consistent for the GP and HOV lanes in both the northbound and southbound directions. In both the Existing and 2035 No-Build scenarios, northbound GP drivers take an average of approximately 30 minutes to traverse the entire corridor from Garrisonville Road to Duke Street. In the peak direction, (southbound), the travel time is between 55 to 58 minutes between Duke Street to Garrisonville Road.

There are significant travel time savings in the peak (southbound) direction for the Build scenario. Travel times in the GP lanes are projected to decrease by approximately 10 minutes in the Build scenario when compared to No-build or Existing. Similar travel time savings are projected for the HOT/HOV facility in the Build scenario.

Exhibit 9-22: Travel Times Summary for 2035 PM Peak Hour Build and No-Build Scenarios



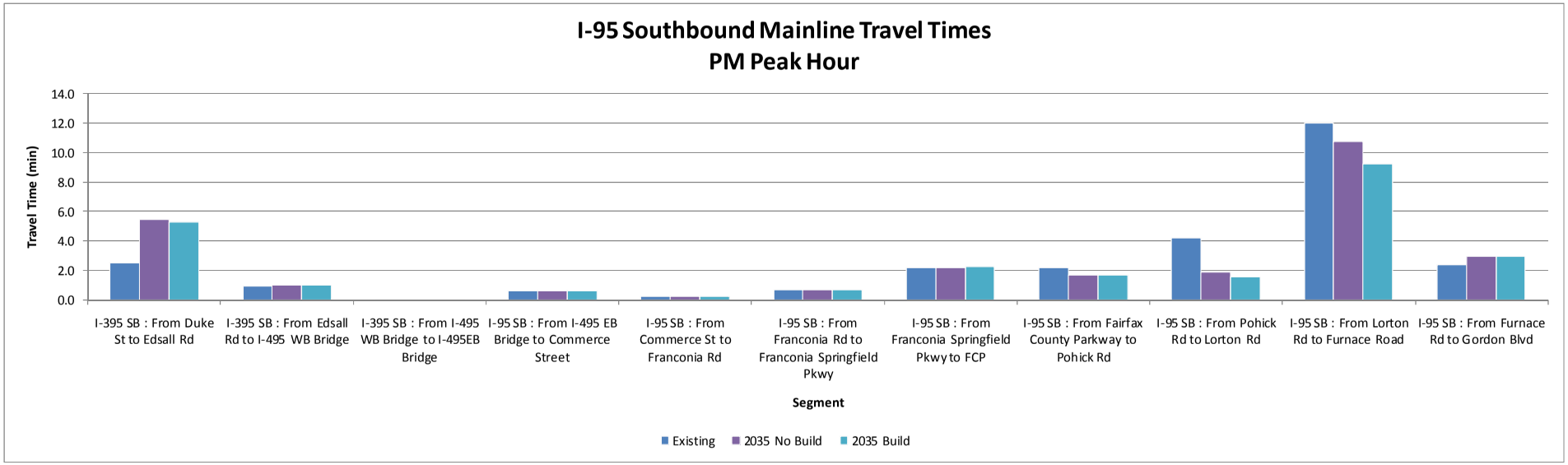
The only segment that is projected to have a significant increase in travel time for the 2035 scenarios is for the southbound I-395 between Duke Street and I-495 in 2035. A more detailed review reveals that the increase in travel time is due to higher traffic demand on the GP lanes north of Edsall Road in 2035 compared to Existing conditions. In addition, the future scenarios show different traffic patterns in this area generated by higher percentage of vehicles exiting to I-495 eastbound and westbound in both No-Build and Build scenarios. The weave segment between the on and off ramps at the Duke Street interchange is a major corridor bottlenecks and causes significant congestion on southbound I-395 during the PM peak. This condition is exacerbated in both the No-Build and Build scenarios given the higher demand.

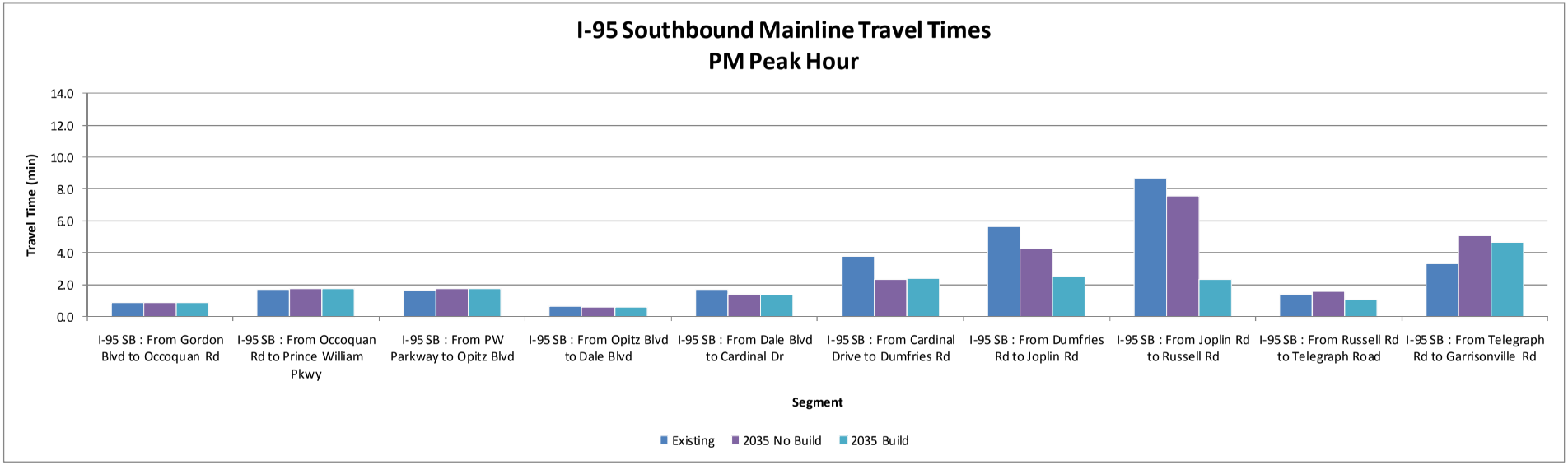
Exhibit 9-23 depicts the 2035 No-Build and 2035 Build travel times along the I-95 GP lanes for each freeway segment measured between adjacent interchanges in the southbound direction during the PM peak hour. As shown in this figure, most segments are projected to have similar travel times in Existing, 2035 No-Build, and 2035 Build conditions with the following exceptions:

- I-95 GP lanes from Duke Street to Edsall Road - As explained in Section 9.3.3.1, demand is significantly higher in both No-build and Build scenarios compared to Existing conditions. The pre-existing congestion at Duke Street is exacerbated in the future with the increase in demand
- I-95 GP lanes from Pohick Road to Furnace Road - These segments show a reduction in travel time for both the No-Build and Build scenarios compared to Existing conditions. The traffic operation in these segments is improved due to the widening of I-95 GP lanes from three lanes in the Existing conditions to four lanes in both future scenarios. In addition, the Build scenario shows travel times lower than No-Build. This is due to lower demand on the GP lanes on the Build scenario which is shifted to the HOV/HOT facility.
- I-95 GP lanes from South of Dumfries Road to Russell Road - A significant travel time reduction is projected in these segments for the Build scenarios. As described before, this travel time savings are due to the elimination of the HOV Southern Terminus South of Dumfries Road and the replacement of the HOV slip ramp with a flyover, which improves merging conditions.

In conclusion, the overall travel time for the entire corridor improves significantly for the Build scenario in the southbound peak direction for both the GP lanes and the HOV/HOT lanes. This improvement is due mostly to the elimination of the existing bottleneck South of Dumfries Road (location of the existing HOV terminus). The merging condition is eliminated in the Build scenario as the HOV/HOT facility continues south of Dumfries Road and the existing slip ramp is replaced with a flyover ramp that will bring traffic from the HOV/HOT lanes to the GP lanes on the right side. The overall time savings in the 2035 Build scenarios and for the corridor is approximately 10 minutes for both the GP and HOV/HOT lanes.

Exhibit 9-23: Existing, 2035 Build, and 2035 No-Build Travel Times – PM Peak – GP Lanes - Southbound Direction





9.3.3.3 Speed Analysis

Average speeds along the I-95 GP lanes were compared between the Existing, 2035 No-Build, and 2035 Build scenarios using temporal speed diagrams. The data are based on speed measurements taken from the VISSIM model every 0.5 miles and every 15 minutes of simulation.

AM Peak

Exhibit 9-24 is an illustration of the average speed contours for the entire corridor. For the AM peak hour, in the northbound direction, traffic speeds are very similar between the 2035 No-Build and Build scenarios. Based on the entire 32 mile study area from Garrisonville Road to Duke Street, both scenarios have an average speed of 53 mph on the I-95 northbound GP lanes during the AM peak hour.

The 2035 No Build scenario has two locations on the I-95 northbound GP lanes where speeds fall under 50 mph. The first location is at the Fairfax County Parkway interchange, where speeds average approximately 47 mph for a 2.5 mile segment. The second location is between the I-495 Springfield interchange and the Duke Street interchange, where speeds average approximately 29 mph for a 4.5 mile segment.

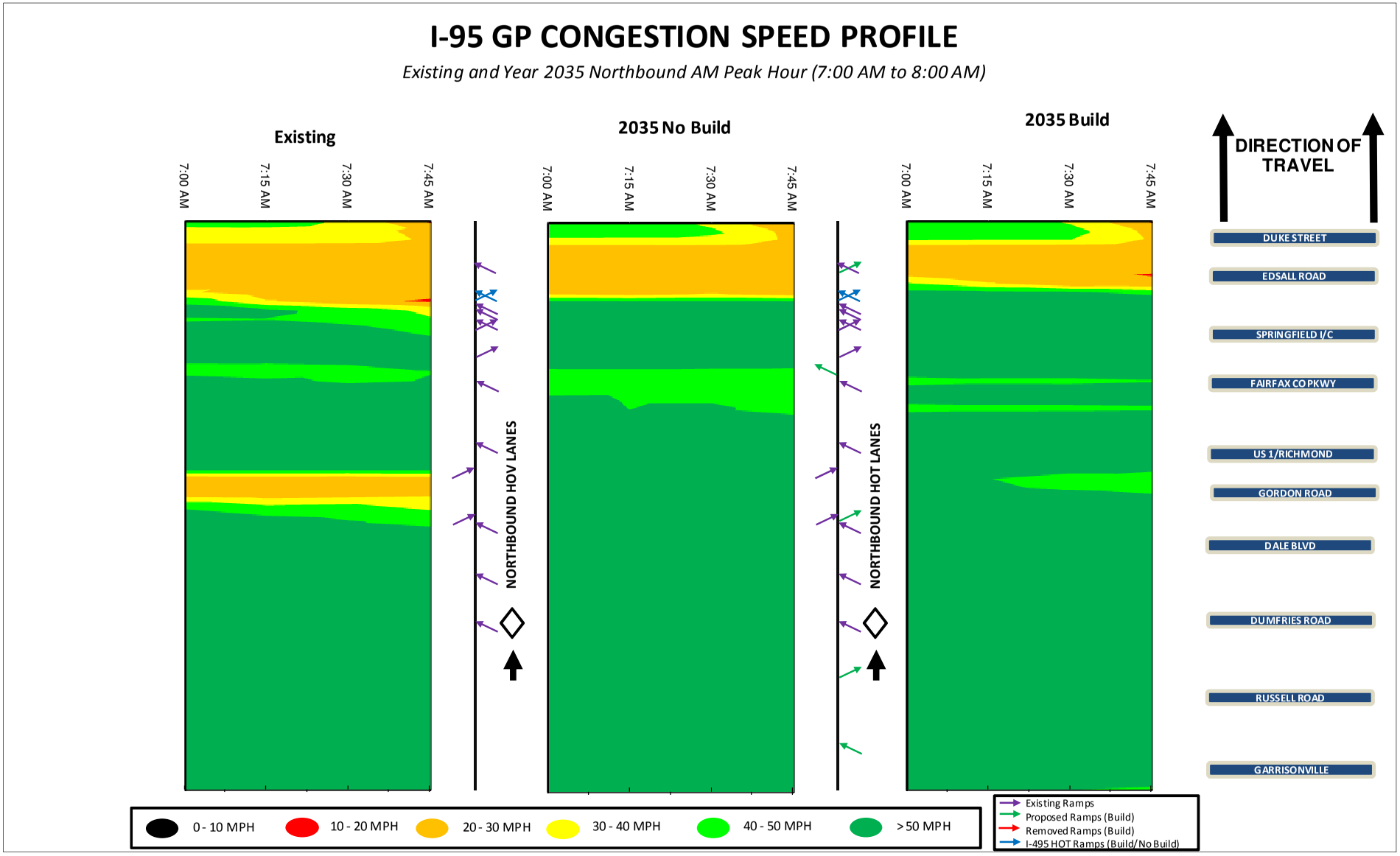
The 2035 Build scenario also has two locations on the I-95 northbound GP lanes where speeds fall under 50 mph. The first location is approaching the Gordon Blvd interchange, where speeds average approximately 49 mph for a 1.0 mile segment. The second location is between the I-495 Springfield interchange and the Duke Street interchange (similar to 2035 No Build), where speeds average approximately 29 mph for a 4.0 mile segment.

Speeds along the I-95 HOV/HOT lane facility are approximately 65 mph for both the 2035 No Build and Build scenarios.

In the southbound direction during the AM peak hour, both the No-Build and Build scenarios will operate comparably in 2035. No significant difference in travel speeds in anticipated in either the No-Build or Build scenarios.

Speed data from the VISSIM model for 2035 AM conditions (No-Build and Build) is also geographically illustrated in **Figures 9-13 and 9-17** for all study segments along the I-95 study corridor.

Exhibit 9-24: Comparison between Existing, 2035 No-Build, and Build Average Speeds AM Peak (Northbound-GP Lanes)



PM Peak

Exhibit 9-25 is an illustration of the average speed contours for the entire corridor. For the PM peak hour, in the southbound direction, traffic speeds generally improve under the Build scenario in comparison to the No-Build scenario. With the exception of the northernmost bottleneck at Duke Street, average speeds improve at all other bottleneck locations. As discussed in Section 9.3.3.1, demand in the GP lanes is generally lower in the southbound direction in the 2035 Build scenario when compared to the No-Build scenario. This decrease in demand reduces the length, duration, and intensity of congestion at all bottlenecks south of Springfield Interchange. The bottlenecks near Dumfries Road and Russell Road are eliminated entirely and the congestion from the bottleneck at Gordon Road is reduced.

At the northernmost bottleneck near the Duke Street and the Edsall Road interchanges, weaving traffic volumes from the I-395 mainline to the I-495 Beltway corridor increases for both the No-Build and Build scenarios when compared to Existing conditions. This increase in demand and change in traffic patterns result in slightly more congestion at this location, measured in both duration and intensity. Therefore vehicle speeds are lower through this section when compared to Existing conditions. When comparing 2035 scenarios, both No-Build and Build scenarios result in similar congestion patterns (duration and intensity) at this bottleneck.

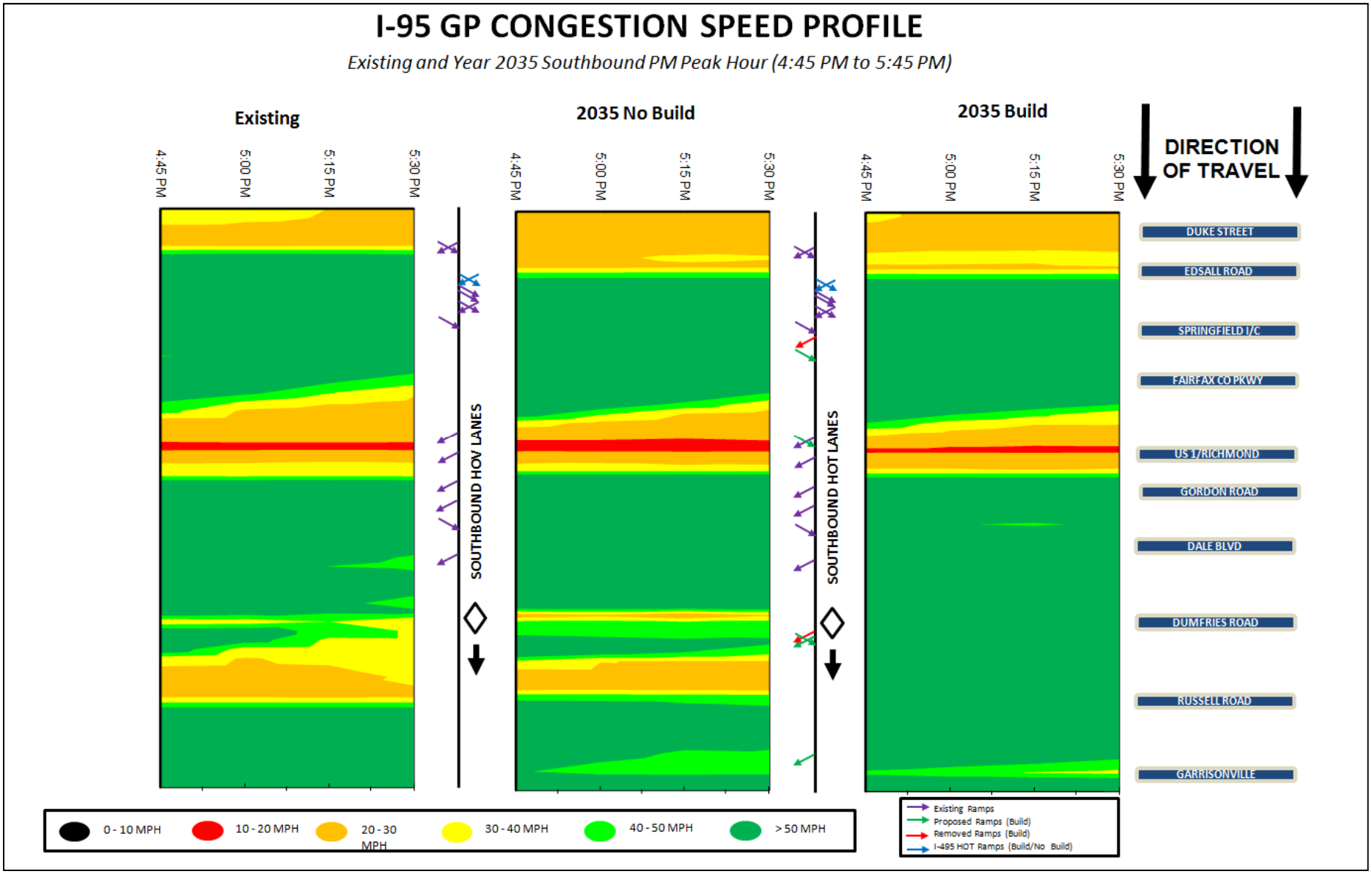
The middle bottleneck, located at the Gordon Road slip ramp merge, will still be present in the 2035 No-Build and Build scenarios. However, the length, duration, and intensity of the congestion associated with this bottleneck are projected to reduce in the future scenarios. This improvement at this bottleneck location is due to a decrease in vehicle demand along the I-95 southbound GP lanes (i.e., cars are shifting to the HOV/HOT lanes). This vehicle shift to the HOV/HOT lanes results in a benefit under the Build scenario while not degrading HOV/HOT lane operations. During the PM peak hour, the queue through this location is estimated to be 0.5 miles shorter in the Build scenario when compared to the No-Build condition.

Average vehicle speeds are projected to range between 18 and 30 mph between the Gordon Road merge and the US 1 (Richmond Highway) weave section under both the 2035 No-Build and Build scenarios. Similarly, in both 2035 scenarios vehicle speeds will be close to free-flow speeds from south of Edsall Road to Fairfax County Parkway.

The southernmost bottleneck in the study area is due to the Russell Road on-ramp merge combined with the HOV lane southern terminus merge in the No–Build condition. In the Build scenario, this bottleneck disappears due to two reasons:

- As described in section 9.3.3.1, traffic demand through the Russell Road on-ramp merge segment decrease by 35 percent compared to the No-Build scenario. This volume decrease allows the I-95 mainline to operate below capacity in the Build condition. Therefore, the bottleneck at Russell Road does not form in the Build scenario.
- The shift of the southern terminus in the Build scenario eliminates the friction that occurs in the No-Build condition at the Dumfries Road HOV merge area. Traffic speeds are anticipated to be near free-flow through this section under the Build scenario.

Exhibit 9-25: Comparison between Existing, 2035 No-Build, and Build Average Speeds PM Peak (Southbound-GP Lanes)



In the northbound direction during the PM peak hour, both the No-Build and Build scenarios will operate comparably in 2035. No significant difference in travel speeds in anticipated in either the No-Build or Build scenarios.

In the northbound direction, for both the No-Build and Build scenarios, the HOV/HOT lanes are expected to operate near free-flow speeds along most segments of the corridor. Similar to Existing conditions, some reduction in speed is anticipated near the southern terminus at the Dumfries interchange under the No-Build scenario. However, this slowing would be localized to that short segment. No significant congestion is anticipated along the rest of the corridor. In the Build scenario, no degradation in travel speeds is expected due to either the increased volume or the increase in ingress/egress locations along the HOV/HOT lane facility.

Speed data from the VISSIM model for 2035 PM conditions (No-Build and Build) is also geographically illustrated in **Figures 9-15 and 9-19** for all study segments along the I-95 study corridor.

9.3.3.4 Volume Served Analysis

Throughput volumes and percent of demand unserved were compared between the 2035 No-Build and Build scenarios. Throughput volume and percent of demand unserved are both measured by combining the GP and HOV/HOT lanes along I-95 between Garrisonville Road and Duke Street in the AM northbound direction and from Duke Street to south of Garrisonville Road in the PM southbound direction.

AM Peak

In the AM peak hour, the 2035 Build scenario has higher throughput volumes than the 2035 No-Build scenario throughout the entire corridor. The main throughput volume differences are found in segments with little or no congestion while congested, over-saturated areas show much smaller differences.

Table 9-30 and **Exhibit 9-26** compare volume throughput and percent demand unserved between the 2035 No-Build and 2035 Build AM peak hour scenarios. As discussed in section 9.3.3.1, the Build scenario has more demand (GP and HOV/HOT lane trips) in the peak northbound direction of travel when compared to the No-Build scenario. Under the Build scenario, the volume served is greater than the No-Build scenario throughout the entire study area along the peak direction of travel (northbound). Typically, the Build scenario is able to serve between five and 28 percent more vehicles per hour depending on the segment along the corridor. Furthermore, the percent unserved is the same or less in the Build scenario compared to the No-Build. The conclusion is that the Build scenario is able to serve more vehicles while fewer vehicles are not able to enter the network. This represents a significant improvement in the overall efficiency of the system.

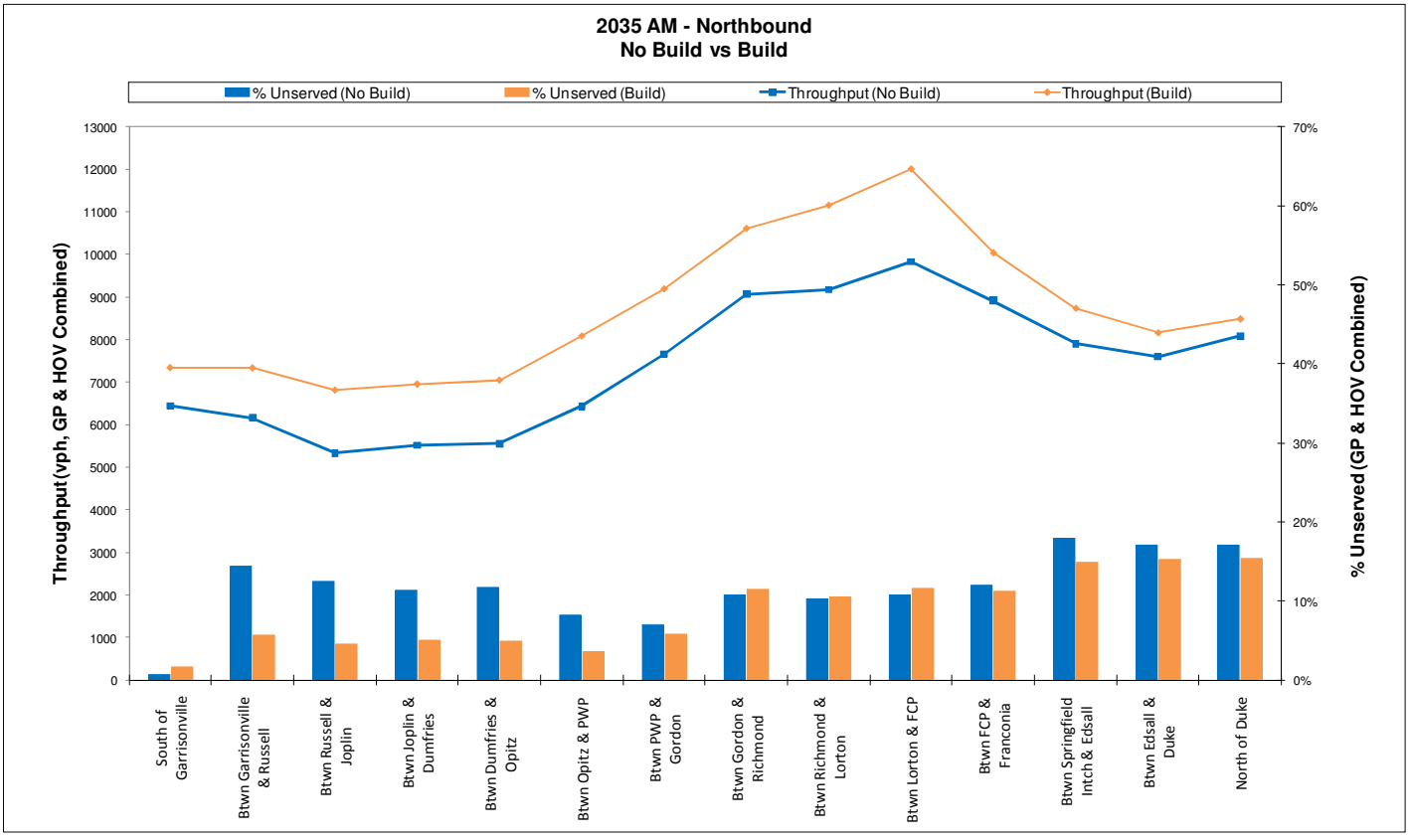
The segment with the highest percentage difference in throughput as well as percent unserved is between Garrisonville Road and Prince William Parkway, where the Build scenario serves between 19 and 28 percent more vehicles while percent unserved is four to eight percent less than the No-Build scenario. Due to the increased capacity along the HOV/HOT facility, the facility as a whole is able to serve the increase in vehicle demand.

In the off-peak, southbound direction, the differences in throughput volumes and relative percent unserved are negligible between the two scenarios.

Table 9-30: Vehicle Throughput and Percent Unserved Comparison for 2035 No-Build and Build AM Northbound

Screenline Location	2035 No Build AM						2035 Build AM						Throughput Volume Difference	
	Throughput Volume (veh/hr)			Percent Unserved			Throughput Volume (veh/hr)			Percent Unserved				
	GP	HOV	Overall	GP	HOV	Overall	GP	HOV/HOT	Overall	GP	HOT/HOV	Overall	Abs Diff	% Diff
South of Garrisonville Rd	6443	0	6443	1%	0%	1%	5304	2037	7341	3%	0%	2%	898	14%
Between Garrisonville Rd & Russell Rd	6163	0	6163	14%	0%	14%	4877	2457	7334	8%	0%	6%	1171	19%
Between Russell Rd & Joplin Rd	5336	0	5336	12%	0%	12%	4577	2237	6814	6%	1%	5%	1478	28%
Between Joplin Rd & Dumfries Rd	5522	0	5522	11%	0%	11%	4717	2237	6954	7%	1%	5%	1432	26%
Between Dumfries Rd & Opitz Blvd	4514	1042	5556	12%	12%	12%	4335	2711	7046	7%	1%	5%	1490	27%
Between Opitz Blvd & PWP	4812	1625	6437	8%	8%	8%	4569	3513	8082	6%	1%	4%	1645	26%
Between PWP & Gordon Blvd	5204	2459	7663	8%	6%	7%	5359	3829	9188	9%	1%	6%	1525	20%
Between Gordon Blvd & Richmond Hwy	6190	2884	9074	12%	9%	11%	6179	4428	10607	15%	7%	11%	1533	17%
Between Richmond Hwy & Lorton Rd	6154	3021	9175	11%	9%	10%	6203	4951	11154	14%	6%	11%	1979	22%
Between Lorton Rd & FCP	6784	3047	9831	11%	11%	11%	6921	5082	12003	14%	8%	12%	2172	22%
Between FCP & Franconia Rd	6555	2361	8916	11%	14%	12%	6610	3425	10035	13%	7%	11%	1119	13%
Between Springfield IC & Edsall Rd	5400	2506	7906	20%	14%	18%	5119	3613	8732	18%	10%	15%	826	10%
Between Edsall Rd & Duke St	4853	2745	7598	19%	13%	17%	5208	2953	8161	18%	9%	15%	563	7%
North of Duke St	5338	2745	8083	19%	13%	17%	5530	2953	8483	18%	9%	15%	400	5%
													Average	**18%**

Exhibit 9-26: Vehicle Throughput and Unserved Demand Comparison for 2035 No-Build and Build AM Northbound



PM Peak

In the PM peak hour, the 2035 Build scenario has higher throughput volumes than the 2035 No-Build scenario throughout the entire corridor. The main throughput volume differences are found in segments with little or no congestion while congested, over-saturated areas show much smaller differences.

Table 9-31 and **Exhibit 9-27** compare volume throughput and percent demand unserved between the 2035 No-Build and 2035 Build PM peak hour scenarios. As discussed in section 9.3.3.1, the Build scenario has more demand (GP and HOV/HOT lane trips) in the peak southbound direction of travel when compared to the No-Build scenario. Under the Build scenario, the volume served is greater than the No-Build scenario throughout the entire study area along the peak direction of travel (southbound). Typically, the Build scenario is able to serve between 8 to 30 percent more vehicles per hour depending on the segment along the corridor. Furthermore, the percent unserved is typically less in the Build scenario compared to the No-Build. The conclusion is that the Build scenario is able to serve more vehicles while fewer vehicles are not able to enter the network. This represents a significant improvement in the overall efficiency of the system.

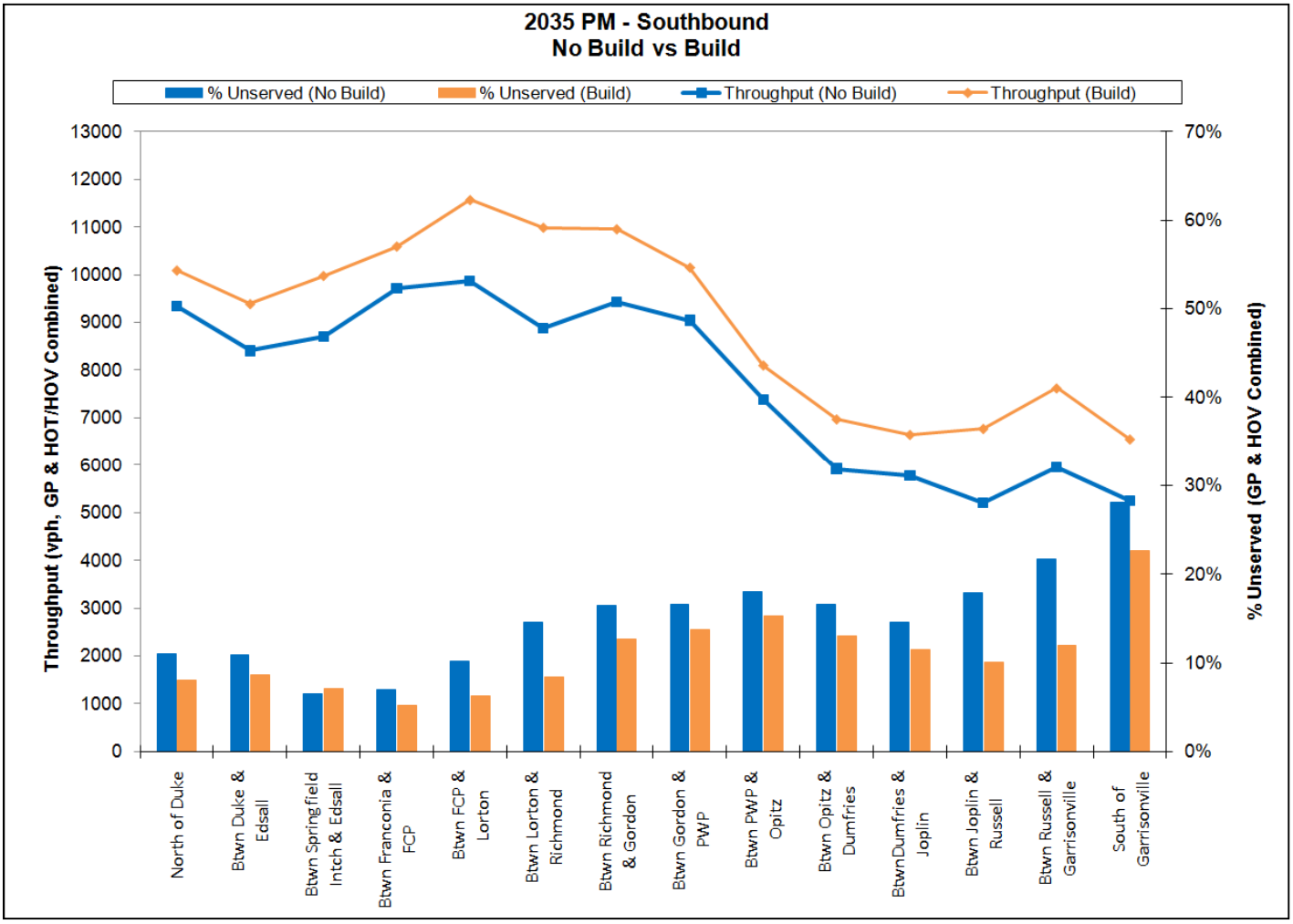
The segment between Fairfax County Parkway and Gordon Road shows the greatest project related benefit. Through this segment, the Build scenario is able to serve between 1,700 and 2,100 more vehicles per hour and the percent unserved is 4 to 7 percent less than the No-Build scenario. This improvement is primarily the result of toll-paying motorists shifting their trip from the GP lanes to the HOV/HOT lanes to avoid the congestion between Gordon Road and Fairfax County Parkway. Due to the increased capacity along the HOV/HOT facility, the facility as a whole is able to serve the increase in vehicle demand.

In the off-peak, northbound direction, the differences in throughput volumes and relative percent unserved are negligible between the two scenarios.

Table 9-31: Vehicle Throughput and Unserved Demand Comparison for 2035 Build and No-Build PM

Screenline Location	2035 No Build PM						2035 Build PM						Throughput Volume Difference	
	Throughput Volume (veh/hr)			Percent Unserved			Throughput Volume (veh/hr)			Percent Unserved				
	GP	HOV	Overall	GP	HOV	Overall	GP	HOV/ HOT	Overall	GP	HOT/ HOV	Overall	Abs Diff	% Diff
North of Duke St	6631	2717	9348	15%	0%	11%	6763	3330	10093	12%	0%	8%	745	8%
Between Duke St & Edsall Rd	5690	2717	8407	15%	0%	11%	6056	3334	9390	13%	0%	9%	983	12%
Between Edsall Rd & Springfield IC	5874	2829	8703	13%	0%	6%	5696	4283	9979	10%	2%	7%	1276	15%
Between Franconia Rd & FCP	6944	2769	9713	8%	3%	7%	7159	3435	10594	6%	3%	5%	881	9%
Between FCP & Lorton Rd	6556	3319	9875	14%	3%	10%	6522	5043	11565	9%	2%	6%	1690	17%
Between Lorton Rd & Richmond Hwy	5625	3262	8887	20%	3%	15%	5925	5063	10988	13%	2%	8%	2101	24%
Between Richmond Hwy & Gordon Blvd	6357	3068	9425	20%	7%	16%	6308	4648	10956	17%	6%	13%	1531	16%
Between Gordon Blvd & PWP	6169	2874	9043	21%	4%	17%	6065	4088	10153	18%	6%	14%	1110	12%
Between PWP & Opitz Blvd	5486	1901	7387	22%	3%	18%	5606	2499	8105	18%	8%	15%	718	10%
Between Opitz Blvd & Dumfries Rd	4529	1389	5918	20%	5%	17%	4736	2241	6977	15%	9%	13%	1059	18%
Between Dumfries Rd & Joplin Rd	5771	0	5771	15%	0%	15%	4706	1946	6652	11%	12%	11%	881	15%
Between Joplin Rd & Russell Rd	5211	0	5211	18%	0%	18%	4267	2510	6777	11%	9%	10%	1566	30%
Between Russell Rd & Garrisonville Rd	5960	0	5960	22%	0%	22%	5115	2510	7625	13%	9%	12%	1665	28%
South of Garrisonville Rd	5248	0	5248	28%	0%	28%	4924	1633	6557	26%	12%	23%	1309	25%
													Average	**17%**

Exhibit 9-27: Vehicle Throughput and Unserved Demand Comparison for 2035 No-Build and Build PM Southbound



9.3.3.5 Freeway Density Analysis

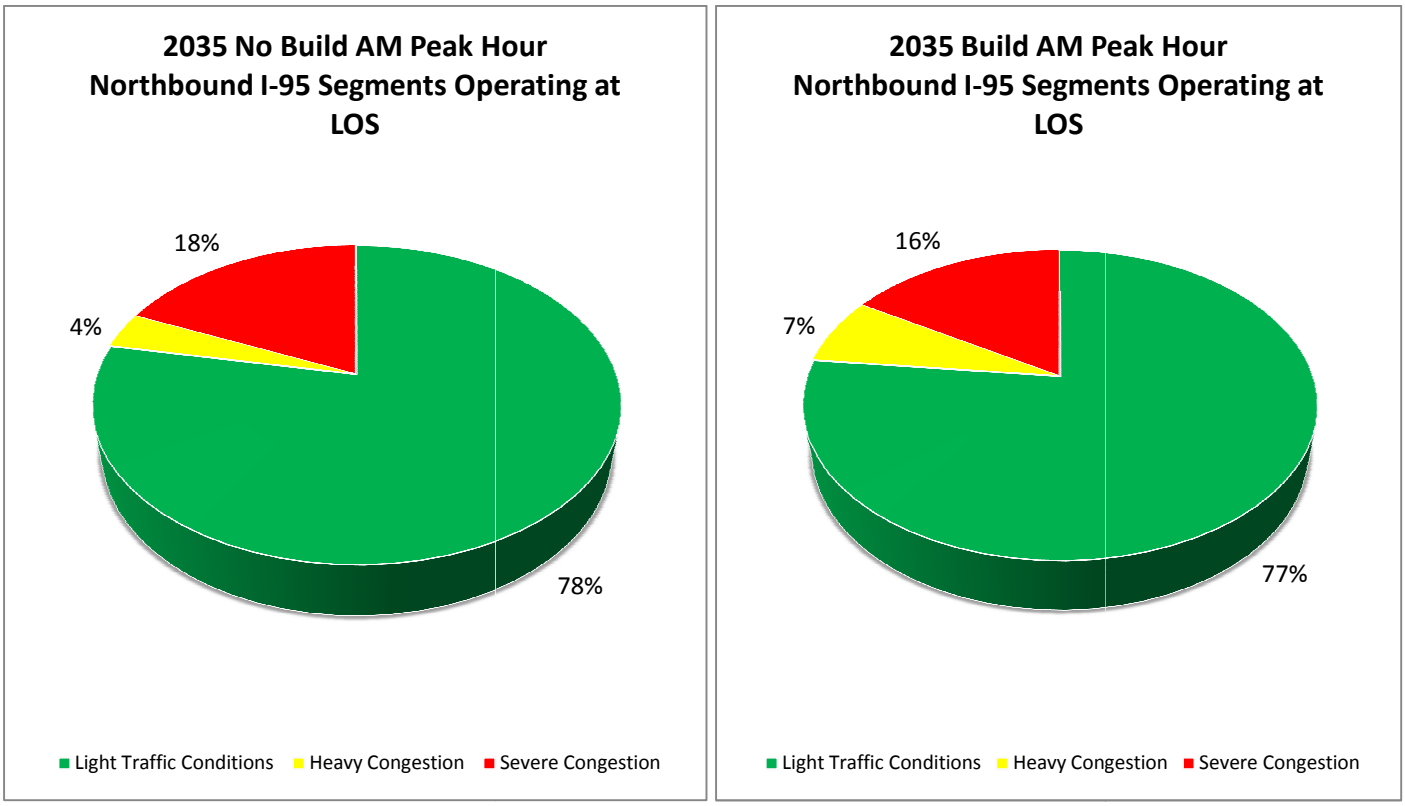
AM Peak

Exhibit 9-28 is a summary of freeway segment density measured in vehicles per mile per lane along the I-95 mainline in the northbound AM peak direction. In the 2035 No-Build scenario, there are 43 basic, six weaving, and 33 merge/diverge segments for a total of 82 segments in the northbound direction. In the 2035 Build scenario, there are 45 basic, eight weaving, and 31 merge/diverge segments for a total of 84 segments in the northbound direction. The difference in the number of segments between the two scenarios is due to the additional access provided along the facility in the Build scenario.

In both the 2035 No-Build and Build scenarios, almost 80 percent of the total mainline segments operate under acceptable traffic conditions (LOS D or better). The 2035 Build scenario has slightly less segments operating at severe congestion levels, with 16 percent for 2035 Build compared to 18 percent for 2035 No Build.

Overall, No Build and Build conditions on the I-95 NB GP lanes are similar in the 2035 AM peak hour.

Exhibit 9-28: Summary of Freeway Traffic Conditions Measured by Density – 2035 AM No-Build and Build Scenarios



Basic Freeway Segments

As shown in **Table 9-32**, in the 2035 No-Build scenario there are 43 basic segments out of which seven operate under severe congested conditions, two segments operate under heavy congested conditions and the rest of the 34 segments operate under acceptable traffic conditions. In comparison under the 2035 Build scenario, only seven freeway basic segments out of a total of 45 operate under severe congestion while only three segments operate under heavy congestion. The remaining 35 segments operate under acceptable traffic conditions. Operating conditions of the freeway basic segments in the peak northbound direction are similar between the No-Build and Build conditions.

Weave Segments

Table 9-33 summarizes the density analysis for the weave segments in the 2035 No-Build and Build scenarios. There are a total of six weave segments in the 2035 No-Build scenario compared to seven in the 2035 Build scenario. Of the six common weave segments between both the 2035 No-Build and Build scenarios, only one segment experiences higher congestion in the Build scenario (between the Gordon Boulevard southbound on-ramp and northbound off-ramp), going from light traffic conditions in the No-Build scenario to heavy congestion in the Build scenario. The new segment created in the 2035 Build scenario, is between the Turkeycock HOT exit ramp and the Duke Street eastbound off-ramp. This segment operates under severe congested conditions caused by downstream queues outside the study area. The other new segment is between the Truck Rest Area and the HOT entrance ramp just north of Dumfries Road, which operates under light traffic conditions.

Table 9-32: Northbound Freeway Basic Segments Density Analysis for 2035 No-Build and Build AM

Basic Freeway Segments		2035 AM No Build			2035 AM Build		
ID	Description	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS
FGN095Gar01#01	From south of Garrisonville Rd to I-95 NB Off-ramp to US-1	36	62	E	54	42	F
FGN095Gar02#03	Between I-95 NB Off-ramp to US-1 and I-95 NB On-ramp from Garrisonville Rd EB	31	61	D	28	56	D
FGN095Gar03#05	Between I-95 NB Off-ramp to Garrisonville Rd WB and I-95 NB On-ramp from US-1	31	58	D	28	57	D
FGN095Rus01#07	Between I-95 NB On-ramp from US-1 and GP-to-HOT ramp n/o Garrisonville Rd	34	60	D	28	63	D
FGN095Rus02#09	Between GP-to-HOT ramp n/o Garrisonville Rd and Off-ramp to Russell Rd	N/A	N/A	N/A	27	60	D
FGN095Rus02#9	Between I-95 NB Off-ramp to Russell Rd and On-ramp from Russell Rd	29	58	D	23	59	C
FGN095Jop01#11	Between I-95 NB On-ramp from Russell Rd and HOT-to-GP ramp n/o Russell Rd	29	61	D	23	62	C
FGN095Jop02#15	Between HOT-to-GP ramp n/o Russell Rd and I-95 NB Off-ramp to Joplin Rd	N/A	N/A	N/A	24	63	C
FGN095Jop02#13	Between I-95 NB Off-ramp to Joplin Rd and On-ramp from Joplin Rd	27	62	D	22	63	C
FGN095Dum01#15	Between I-95 NB On-ramp from Joplin Rd and GP-to-HOT ramp s/o Dumfries Rd	31	59	D	27	59	D
FGN095Dum02#17	Between GP-to-HOT ramp s/o Dumfries Rd and Off-ramp to Dumfries Rd EB	27	58	D	25	58	C
FGN095Dum04#20	Between I-95 NB Off-ramp to Dumfries Rd WB and On-ramp from Dumfries Rd	20	60	C	18	60	C
FGN095Dum05#22	Between I-95 NB On-ramp from Dumfries Rd and Off-ramp to Truck Rest Area	24	64	C	23	64	C
FGN095Dal01#24	Between I-95 NB Off-ramp to Truck Rest Area and On-ramp from Truck Rest Area	24	65	C	23	65	C
FGN095Dal02#27	Between GP-to-HOV/HOT ramp s/o Dale Blvd and Off-ramp to Rest Area	25	61	C	24	61	C
FGN095Dal03#29	Between I-95 NB Off-ramp to Rest Area s/o Dale Blvd and On-ramp from Rest Area	27	57	D	25	57	C
FGN095Dal04#31	Between I-95 NB Off-ramp to Dale Blvd and On-ramp from Opitz Blvd	22	58	C	20	57	C
FGN095PWP01#33	Between I-95 NB On-ramp from Opitz Blvd and Off-ramp to PWP	29	55	D	32	51	D
FGN095PWP02#35	Between I-95 NB Off-ramp to PWP and HOT-to-GP ramp at PWP	25	58	C	29	53	D
FGN095PWP04#41	Between major merge from HOT-to-GP ramp at PWP and On-ramp from PWP	N/A	N/A	N/A	36	51	E
FGN095Gdn01#37	Between I-95 NB On-ramp from PWP and Off-ramp to Gordon Blvd EB	32	55	D	45	47	F
FGN095Gdn02#39	Between I-95 NB Off-ramp to Gordon Blvd EB and On-ramp from Gordon Blvd EB	34	51	D	47	44	F
FGN095Gdn03#41	Between I-95 NB Off-ramp to Gordon Blvd WB and On-ramp from Gordon Blvd WB	27	52	D	26	52	C
FGN095Rt101#43	Between I-95 NB Off-ramp to NB Richmond Hwy and On-ramp from NB Richmond Hwy	24	53	C	24	52	C
FGN095Lor01#45	5-lane Basic segment between I-95 NB On-ramp from NB Richmond Hwy and downstream 4-lane Basic segment	24	50	C	24	51	C
FGN095Lor02#46	4-lane Basic segment between upstream 5-lane Basic segment n/o Richmond Hwy and Off-ramp to Lorton Rd	29	53	D	30	53	D
FGN095Lor03#48	Between I-95 NB Off-ramp to Lorton Rd and On-ramp from Lorton Rd	30	50	D	29	52	D
FGN095FCP01#50	5-lane Basic segment between I-95 NB On-ramp from Lorton Rd and downstream 4-lane Basic segment	33	47	D	27	52	D
FGN095FCP02#51	4-lane Basic segment between upstream 5-lane Basic segment n/o Lorton Rd and GP-to-HOT ramp s/o FCP	45	45	E	34	53	D
FGN095FCP03#53	Between I-95 NB GP-to-HOV/HOT ramp s/o FCP and downstream 5-lane Major Diverge	55	38	F	37	48	E
FGN095FCP04#54	I-95 NB 5-lane Major Diverge s/o FCP	54	36	F	27	52	D
FGN095FCP05#56	Between I-95 NB Off-ramp to FCP and On-ramp from SB FCP	20	53	C	20	53	C
FGN095FCP06#58	Between I-95 NB On-ramp from SB FCP and On-ramp from NB FCP	24	54	C	N/A	N/A	N/A
FGN095FSP01#60	Between I-95 NB On-ramp from NB FCP and HOV/HOT-to-GP flyover n/o FCP	28	54	D	28	54	D
FGN095FSP02#62	Between I-95 NB HOV/HOT-to-GP flyover n/o FCP and Off-ramp to FSP	31	53	D	31	53	D
FGN095Fra01#64	Between I-95 NB Off-ramp to FSP and GP-to-HOV/HOT ramp s/o Franconia Rd	25	54	C	23	54	C
FGN095Fra02#66	Between I-95 NB GP-to-HOV/HOT ramp s/o Franconia Rd and Major Diverge at Franconia Rd	25	53	C	23	52	C
FGN095Fra03#67	Between Major Diverge at Franconia Rd to On-ramp from EB Franconia Rd (left side)	25	54	C	25	52	C
FGN095Spr01#68	Between On-ramps from EB Franconia Rd on left and right-sides of I-95 NB	25	53	C	24	51	C
FGN095Spr02#69	Between On-ramp from EB Franconia Rd on right-side of I-95 NB and Major Diverge s/o Springfield IC	20	56	C	20	53	C
FGN095Spr03#70	Between Major Diverge s/o Springfield IC and I-395 NB On-ramp from Franconia Rd	22	56	C	18	57	B
FGN095Spr04#72	Between I-395 NB On-ramp from Franconia Rd and On-ramp from I-495 EB/WB	98	14	F	40	34	E
FGN395Eds01#75	Between I-395 NB Off-ramp to WB Edsall Rd and On-ramp from Edsall Rd	95	16	F	102	13	F
FGN395Duk01#77	Between I-395 NB GP-to-HOV/HOT flyover and HOT-to-GP flyover s/o Duke St	82	20	F	94	16	F
FGN395Duk02#80	Between I-395 NB Off-ramp to WB Duke St and On-ramp from Duke St	93	17	F	88	21	F
FGN395Sem01#82	Between I-395 NB On-ramp from Duke St and n/o Duke St	53	34	F	57	33	F

Table 9-33: Northbound Freeway Weave Segments Density Analysis for 2035 No-Build and Build AM

Weave Segments		2035 AM No Build			2035 AM Build		
ID	Description	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS
WGN095Gar01#04	Between I-95 NB On-ramp from EB Garrisonville Rd and Off-ramp to WB Garrisonville Rd	32	52	D	35	45	D
WGN095Dal01#30	Between I-95 NB On-ramp from Rest Area s/o Dale Blvd and Off-ramp to Dale Blvd	21	55	C	21	55	C
WGN095Gdn01#40	Between I-95 NB On-ramp from SB Gordon Blvd and Off-ramp to NB Gordon Blvd	31	42	D	42	40	E
WGN095Rt101#42	Between I-95 NB On-ramp from Gordon Blvd and Off-ramp to NB Richmond Hwy	24	51	C	25	50	C
WGN395Eds01#73	Between I-395 On-ramp from I-495 EB/WB and Off-ramp to Edsall Rd	116	11	F	72	18	F
WGN395Duk01#76	Between I-395 NB On-ramp from Edsall Rd and GP-to-HOT flyover s/o Duke St	88	17	F	99	14	F
WGN395Duk01#82	Between I-395 NB HOT-to-GP flyover s/o Duke St and Off-ramp to EB Duke St	N/A	N/A	N/A	92	16	F

Ramp Junctions

The density analysis for the ramp junctions includes all diverge and merge segments for the 2035 No-Build and Build scenarios. The results of the ramp junction analysis are shown in **Table 9-34**. There are a total of 33 ramp junction segments in the 2035 No-Build but only 31 under the 2035 Build scenario. In the 2035 No-Build scenario a total of eight or 24 percent of the ramp junction segments operate under heavy or severe congested conditions while the remaining 25 segments operate under acceptable operating conditions. It is projected that under the Build scenario, only 19 percent of the ramp junction segments amounting to six segments will operate under heavy to severe congested conditions while the remaining 25 segments will operate under acceptable conditions.

Table 9-34: Northbound Freeway Ramp Junction Segments Density Analysis for 2035 No-Build and Build AM

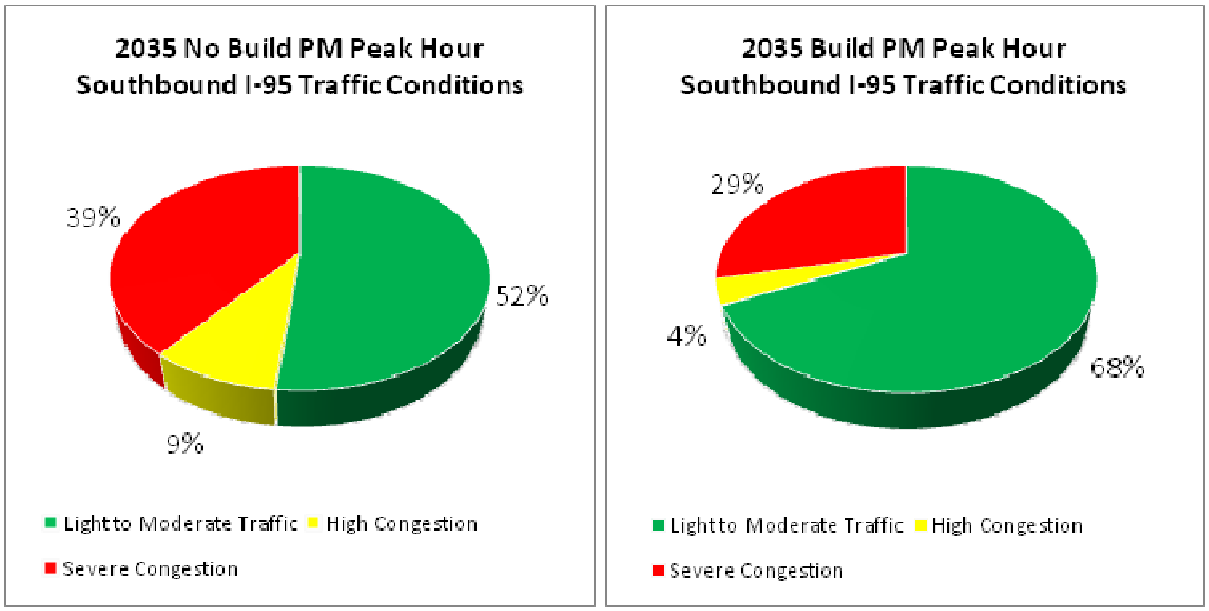
Ramp Junctions		2035 AM No Build			2035 AM Build		
ID	Description	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS
DGN095Gar01#02	I-95 NB Off-ramp to US-1	31	59	D	62	32	F
MGN095Gar01#06	I-95 NB On-ramp from US-1	26	56	C	22	58	C
DGN095Rus01#08	I-95 NB GP-to-HOT ramp s/o Russell Rd	N/A	N/A	N/A	29	53	D
DGN095Rus01#8	I-95 NB Off-ramp to Russell Rd	39	46	E	27	52	C
MGN095Rus01#10	I-95 NB On-ramp from Russell Rd	27	54	C	22	55	C
MGN095Jop01#14	I-95 NB HOT-to-GP ramp s/o Joplin Rd	N/A	N/A	N/A	21	61	C
DGN095Jop01#12	I-95 NB Off-ramp to Joplin Rd	25	60	C	21	61	C
MGN095Jop01#14	I-95 NB On-ramp from Joplin Rd	27	56	C	23	57	C
DGN095Dum01#16	I-95 NB GP-to-HOV/HOT ramp s/o Dumfries Rd	27	58	C	23	59	C
DGN095Dum02#18	I-95 NB Off-ramp to Dumfries Rd EB	19	58	B	19	59	B
DGN095Dum03#19	I-95 NB Off-ramp to Dumfries Rd WB	21	57	C	21	56	C
MGN095Dum01#21	I-95 NB On-ramp from Dumfries Rd	21	62	C	21	61	C
DGN095Dal01#23	I-95 NB Off-ramp to Truck Rest Area n/o Dumfries Rd	21	64	C	20	64	B
MGN095Dal01#25	I-95 NB On-ramp fro Truck Rest Area n/o Dumfries Rd	18	59	B	N/A	N/A	N/A
DGN095Dal02#26	I-95 NB GP-to-HOV/HOT ramp s/o Dale Blvd	19	64	B	N/A	N/A	N/A
DGN095Dal03#28	I-95 NB Off-ramp to Rest Area s/o Dale Blvd	23	57	C	22	57	C
MGN095Opt01#32	I-95 NB On-ramp from Rest Area s/o Dale Blvd	20	53	B	23	48	C
DGN095PWP01#34	I-95 NB Off-ramp to Prince William Pkwy	24	58	C	27	53	C
MGN095PWP01#36	I-95 NB On-ramp from Prince William Pkwy	26	55	C	38	47	E
DGN095Gdn01#38	I-95 NB Off-ramp to Gordon Blvd SB	29	52	D	41	45	E
MGN095Rt101#44	I-95 NB On-ramp from Richmond Hwy NB	21	52	C	22	52	C
DGN095Lor01#47	I-95 NB Off-ramp to Lorton Rd	27	50	C	27	51	C
MGN095Lor01#49	I-95 NB On-ramp from Lorton Rd	29	47	D	26	50	C
DGN095FCP01#52	I-95 NB GP-to-HOV/HOT ramp s/o Fairfax County Pkwy	47	41	F	34	48	D
DGN095FCP01#55	I-95 NB Off-ramp to Fairfax County Pkwy	48	39	F	N/A	N/A	N/A
MGN095FCP01#57	I-95 NB On-ramp from Fairfax County Pkwy SB	20	50	B	22	52	C
MGN095FCP02#59	I-95 NB On-ramp from Fairfax County Pkwy NB	25	53	C	25	53	C
MGN095FSP01#61	I-95 NB HOV/HOT-to-GP flyover n/o Fairfax County Pkwy	29	50	D	31	47	D
DGN095FSP01#63	I-95 NB Off-ramp to Franconia-Springfield Pkwy	27	54	C	28	53	C
DGN095Fra01#65	I-95 NB GP-to-HOV/HOT s/o Franconia Rd	25	54	C	24	53	C
MGN095Spr01#71	I-395 NB On-ramp from Franconia Rd WB	42	33	E	21	49	C
DGN395Eds01#74	I-395 NB Off-ramp to Edsall Rd WB	79	20	F	78	19	F
DGN395Duk01#78	I-395 NB Off-ramp to Duke St EB	72	21	F	N/A	N/A	N/A
DGN395Duk02#79	I-395 NB Off-ramp to Duke St WB	80	20	F	94	19	F
MGN395Duk01#81	I-395 NB On-ramp from Duke St	80	23	F	74	25	F

Figure 9-14 and 9-18 illustrates the LOS results from the VISSIM modeling geographically along all segments of I-95 in the study area for 2035 AM conditions (No-Build and Build).

PM Peak

Exhibit 9-29 is a summary of freeway segment density measured in vehicles per mile per lane along the I-95/I-395 mainline segments in the southbound PM peak direction. In the 2035 Build scenario, almost 70 percent of the total mainline segments operate under acceptable traffic conditions (LOS D or better). In comparison, only 52 percent are projected to operate under acceptable traffic conditions in the No-Build scenario.

Exhibit 9-29: Summary of Freeway Traffic Conditions Measured by Density - 2035 No-Build and Build Scenarios



Basic Freeway Segments

As seen in **Table 9-35**, in the 2035 PM No-Build scenario there are 43 basic segments out of which 16 operate under severe congested conditions (LOS F), five segments operate under heavy congested conditions (LOS E) and the rest 22 segments operate under acceptable traffic conditions (LOS D or better). In comparison in the 2035 Build scenario, only 10 freeway basic segments out of a total of 41 operate under severe congestion while only two segments operate under heavy congestion. The remaining 29 segments operate under acceptable traffic conditions. Overall, the analysis shows a significant improvement with fewer segments operating in congested conditions in the Build scenario in the southbound direction.

Table 9-35: Southbound Freeway Basic Segments Density Analysis for 2035 No-Build and Build PM

Basic Freeway Segments			2035 PM No Build			2035 PM Build		
ID	Description	Facility Type	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS
FGS395Sem01#1	Between Seminary Rd and I-395 Off ramp to Duke St	Basic	105	17	F	103	17	F
FGS395Duk01#3	4-lane segment between I-395 SB Off ramp to Duke St and downstream 3-lane segment n/o Duke St	Basic	96	16	F	95	16	F
FGS395Duk02#4	3-lane segment between upstream 4-lane segment and I-395 On ramp from Duke St WB	Basic	87	22	F	90	22	F
FGS395Duk03#6	Between I-395 Off ramp to Duke St EB and I-395 On ramp from Duke St	Basic	94	18	F	87	21	F
FGS395Duk04#9	Between I-395 Off Ramp to HOV/HOT SB Off and On Ramps	Basic	94	20	F	81	22	F
FGS395Eds01#11	Between I-395 Off ramp to Edsall Rd WB and I-395 On ramp from Edsall Rd WB	Basic	100	18	F	102	16	F
FGS395Eds02#13	3-lane segment between I-395 Off ramp to Edsall Rd EB and downstream 4-lane segment	Basic	44	41	E	44	40	E
FGS395Eds03#14	4-lane segment between upstream 3-lane segment and I-395 On ramp from Edsall Rd EB	Basic	27	52	D	25	51	C
FGS095Spr01#16	Between I-395 SB Off ramp to EB/WB I-495 and I-395 Off ramp to Franconia	Basic	19	61	C	16	61	B
FGS095Spr02#17	Between I-395 Off ramp to Franconia and I-95 On ramp from I-495 EB	Basic	16	62	B	13	62	B
FGS095Spr03#18	4-lane segment between I-95 On ramp from I-495 EB and I-95 On ramp from I-495 WB	Basic	20	58	C	21	58	C
FGS095Fra01#19	6-lane segment between I-95 On ramp from I-495 WB and downstream 5-lane segment s/o Franconia Rd	Basic	18	58	B	18	57	B
FGS095Fra02#20	5-lane segment between upstream 6-lane segment s/o Franconia Rd and I-95 On ramp from Franconia Rd	Basic	21	58	C	21	58	C
FGS095FSP01#22	Between I-95 On ramp from Franconia Rd and I-95 On ramp from HOT s/o Franconia Rd	Basic	23	58	C	23	57	C
FGS095FSP03#25	4-lane segment between HOT Off Ramp s/o Franconia Rd and downstream 5-lane segment n/o FCP	Basic	24	58	C	27	57	D
FGS095FSP05#27	5-lane segment between upstream 4-lane segment and I-95 SB Off Ramp to FCP WB	Basic	19	60	C	20	60	C
FGS095FCP01#29	Between I-95 Off ramp to FCP WB and I-95 SB On ramp from FCP WB	Basic	20	57	C	21	55	C
FGS095FCP02#31	Between I-95 Off ramp to FCP EB and I-95 SB On ramp from FCP EB	Basic	20	61	C	21	61	C
FGS095FCP03#33	Between I-95 On ramp from FCP EB and I-95 SB On ramp from HOV SB s/o FCP	Basic	27	61	D	N/A	N/A	N/A
FGS095Lor01#35	Between I-95 SB On ramp from FCP and I-95 SB Off ramp to Lorton Rd	Basic	29	58	D	27	61	D
FGS095Lor02#37	Between I-95 SB Off ramp to Lorton Rd and I-95 SB On ramp from Lorton Rd	Basic	50	34	F	30	48	D
FGS095Rt101#39	Between Lorton Rd and Richmond Hwy	Basic	103	15	F	84	22	F
FGS095Rt101#41	Between I-95 SB Off ramp to HOT s/o Richmond Hwy and I-95 SB On ramp from Richmond Hwy SB	Basic	115	11	F	110	11	F
FGS095Gdn01#43	4-lane segment between I-95 SB Off ramp to Gordon Blvd WB and downstream 3-lane segment n/o Gordon Blvd	Basic	76	19	F	85	18	F
FGS095Gdn02#44	3-lane segment between upstream 4-lane segment n/o Gordon Blvd and I-95 SB On ramp from Gordon Blvd WB	Basic	95	19	F	N/A	N/A	N/A
FGS095PWP01#47	Between I-95 SB On ramp from Gordon Blvd and I-95 SB Off ramp to PWP	Basic	37	56	E	37	56	E
FGS095PWP02#50	Between I-95 SB Off ramp to PWP EB and PWP SB On ramp	Basic	31	54	D	28	57	D
FGS095PWP03#52	Between PWP and HOV/HOT On ramp to I-95 SB	Basic	39	50	E	33	56	D
FGS095Opt01#55	Between I-95 SB Off ramp to Potomac Mills Rd and On ramp from Dale Blvd	Basic	22	55	C	N/A	N/A	N/A
FGS095Opt01#52	Between I-95 SB Off ramp to HOV/HOT s/o Opitz Blvd and On ramp from Dale Blvd	Basic	N/A	N/A	N/A	20	58	C
FGS095Dal02#58	Between Dale Blvd SB On ramp and HOV/HOT SB Off ramp s/o Dale Blvd	Basic	27	54	D	27	57	D
FGS095Dal03#60	Between HOV/HOT On ramp s/o Rest Area and Truck Rest Area On ramp	Basic	24	63	C	26	63	C
FGS095Dal04#62	Between Truck rest area Off and On ramps	Basic	24	64	C	25	63	C
FGS095Dum01	Between Truck rest area On ramp and Dumfries Rd SB Off ramp	Basic	19	55	C	21	52	C
FGS095Dum02#66	Between I-95 SB Off ramp to Dumfries Rd EB and Dumfries Rd EB On ramp to I-95 SB	Basic	20	61	C	20	62	C
FGS095Dum03#68	Between Dumfries Rd and HOV/HOT SB On ramp s/o Dumfries Rd	Basic	87	16	F	22	62	C
FGS095Dum03#70	Between Dumfries Rd and HOV/HOT SB On ramp s/o Dumfries Rd	Basic	42	46	E	24	56	C
FGS095Jop01#73	Between I-95 SB Off ramp to Joplin Rd and I-95 On ramp from Joplin Rd	Basic	45	41	F	21	62	C
FGS095Jop02#75	Between Joplin Rd and Russell Rd	Basic	98	18	F	23	63	C
FGS095Rus01#77	Between I-95 SB Off ramp to Russel Rd and I-95 SB On ramp from Russell Rd	Basic	102	17	F	22	61	C
FGS095Rus02#79	Between I-95 SB On ramp from Russell Rd and HOV/HOT On ramp n/o Garrinsonville	Basic	42	50	E	30	57	D
FGS095Gar01#81	Between I-95 SB Off ramp to Russell Rd and I-95 SB On ramp from Russell Rd	Basic	68	33	F	70	26	F
FGS095Gar03#85	Between I-95 SB Off ramp to Garrisonville Rd EB and I-95 SB On ramp from Garrisonville Rd EB	Basic	28	62	D	27	54	D
FGS095Gar03#86	Downstream of I-95 On ramp from Garrisonville Rd EB	Basic	28	64	D	27	62	D

Weave Segments

Table 9-36 details the density analysis for the weave segments in the 2035 No-Build and Build scenarios. A similar number of weave segments operate at LOS F (severe congestion) in the No-Build and Build scenarios. The remaining segments operate under acceptable conditions.

Table 9-36: Southbound Freeway Weave Segments Density Analysis for 2035 No-Build and Build PM

Weave Segments			2035 PM No Build			2035 PM Build		
ID	Description	Facility Type	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS
WGS395Duk01#5	Between I-95 On ramp from Duke St WB and Off ramp to Duke St EB	Weave	69	23	F	65	25	F
WGS395Duk02#7	Between I-95 SB On ramp from Duke St and Off Ramp to SB HOV/HOT	Weave	84	20	F	73	26	F
WGS395Eds01#10	Between I-95 SB On ramp from HOV/HOT s/o Duke St and Off ramp to Edsall Rd EB	Weave	79	24	F	81	23	F
WGS395Eds02#12	Between I-95 SB On ramp from Edsall Rd WB and Off ramp to Edsall Rd EB	Weave	78	21	F	79	19	F
WGS395Eds03#15	Between I-95 SB On ramp from Edsall Rd EB and Off ramp to I-495 EB/WB	Weave	21	58	C	20	58	B
WGS095FSP01#23	Between I-95 SB On ramp from HOV/HOT s/o Franconia Rd and Off ramp to Backlick Rd	Weave	24	55	C	25	55	C
WGS095FCP01#30	Between I-95 SB On ramp from FCP WB and Off ramp to FCP EB	Weave	19	57	B	21	56	C
WGS095Rt101#42	Between I-95 SB On ramp from Richmond Highway and Off ramp to Gordon Blvd WB	Weave	82	20	F	81	20	F
WGS095Jop01#66	Between I-95 SB On ramp from HOV/HOT SB s/o Dumfries Rd and Off ramp to HOV/HOT SB	Weave	N/A	N/A	N/A	18	54	B
WGS095Gar01#82	Between I-95 SB On ramp from Garrisonville Rd WB and Off ramp to Garrisonville Rd EB	Weave	83	25	F	87	21	F

Ramp Junctions

The density analysis for the ramp junctions which include all diverge and merge segments for the 2035 No-Build and Build scenarios is shown in **Table 9-37**. There are a total of 31 ramp junction segments in the 2035 No-Build and 32 in the 2035 Build scenario. In the 2035 No-Build scenario, a total of eleven, or approximately 35 percent of the ramp junction segments, operate under severe congested conditions. It is projected that under the Build scenario, only 23 segments (25 percent) of the ramp junction segments will operate under severe congested conditions and while 23 segments (72 percent) will operate under acceptable conditions. This represents a significant improvement in operation compared to the No-Build scenario.

Figure 9-16 and 9-20 illustrates the LOS results from the VISSIM modeling geographically along all segments of I-95 in the study area for 2035 PM conditions (No-Build and Build).

Table 9-37: Southbound Freeway Ramp Junction Segments Density Analysis for 2035 No-Build and Build PM

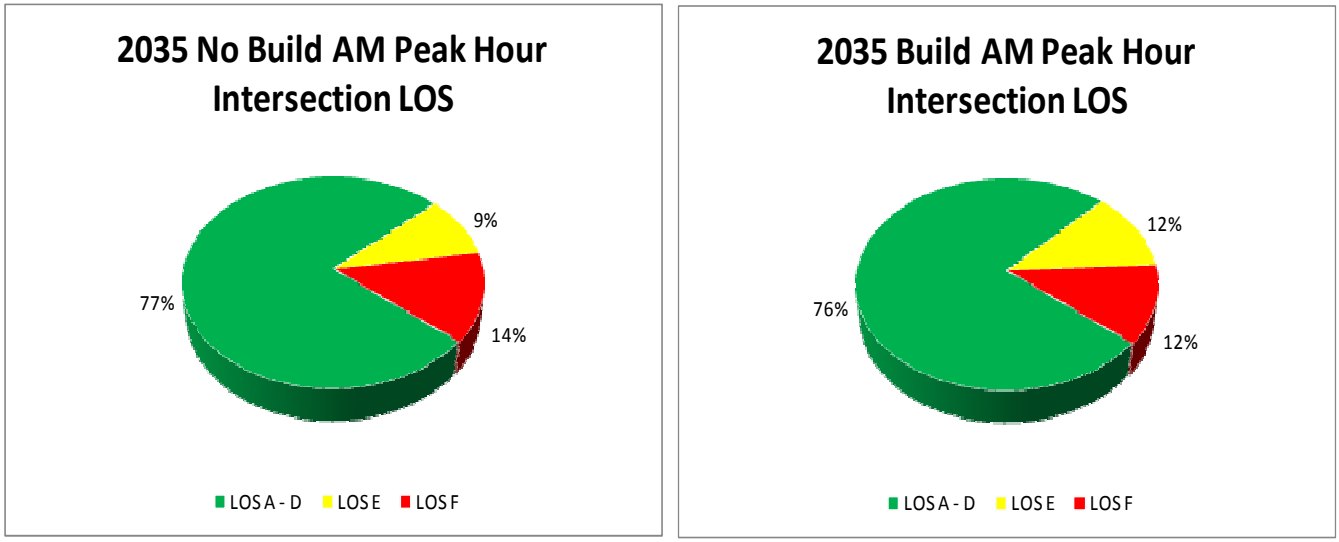
Ramp Junctions			2035 PM No Build			2035 PM Build		
ID	Description	Facility Type	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS	Average Density (veh/mi/ln)	Average Speed (mph)	HCM Equivalent LOS
DGS395Duk01#2	I-395 SB Off Ramp to Duke St WB	Diverge	102	17	F	101	17	F
MGS095Fra01#21	I-95 SB On ramp from Franconia Rd	Merge	22	55	C	22	55	C
DGS095FSP01#24	I-95 SB Off Ramp to Franconia Springfield HOV/HOT SB	Diverge	23	58	C	26	57	C
DGS095FCP01#28	I-95 SB Off Ramp to Fairfax County Pkwy WB	Diverge	21	54	C	25	50	C
MGS095FCP01#32	I-95 SB On ramp from Fairfax County Pkwy	Merge	26	55	C	25	59	C
MGS095FCP02#34	I-95 SB On ramp from HOV/HOT SB s/o FCP	Merge	24	61	C	N/A	N/A	N/A
DGS095Lor01#36	I-95 SB Off Ramp to Lorton Rd	Diverge	42	39	E	39	45	E
MGS095Lor01#38	I-95 SB On ramp from Lorton Rd	Merge	59	23	F	48	31	F
DGS095Rt101#40	I-95 SB Off Ramp to Richmond Hwy SB	Diverge	103	15	F	99	14	F
DGS095Rt102#37	I-95 SB Off Ramp to Richmond Highway HOV/HOT SB	Diverge	N/A	N/A	N/A	95	13	F
MGS095Gdn01#45	I-95 SB On ramp from Gordon Blvd WB	Merge	82	20	F	82	19	F
MGS095Gdn02#46	I-95 SB On ramp from Gordon Blvd EB	Merge	54	32	F	55	30	F
DGS095PWP01#48	I-95 SB Off ramp to PWP WB	Diverge	37	48	E	35	50	D
DGS095PWP02#49	I-95 SB Off ramp to PWP EB	Diverge	29	52	D	26	54	C
MGS095PWP01#51	I-95 SB On ramp from PWP	Merge	33	49	D	29	55	D
MGS095PWP02#53	I-95 SB On ramp from HOV/HOT SB s/o PWP	Merge	33	50	D	26	58	C
DGS095Opt01#54	I-95 SB Off ramp to Optiz Blvd	Diverge	32	47	D	31	47	D
DGS095Opt02#51	I-95 SB Off ramp to HOV/HOT SB s/o Optiz Blvd	Diverge	N/A	N/A	N/A	20	55	B
MGS095Dal01#57	I-95 SB On ramp from Dale Blvd	Merge	24	53	C	24	55	C
MGS095Dal02#59	I-95 SB On ramp from HOV/HOT On ramp s/o Dale Blvd	Merge	22	58	C	23	59	C
DGS095Dal01#61	I-95 SB Off Ramp to Truck Rest Area	Diverge	21	60	C	23	58	C
MGS095Dum01#63	I-95 SB On ramp from Truck rest area	Merge	22	58	C	27	53	C
DGS095Dum01#64	I-95 SB Off ramp to Dumfries Rd WB	Diverge	20	61	B	22	59	C
DGS095Dum02#65	I-95 SB Off ramp to Dumfries Rd	Diverge	23	57	C	22	59	C
MGS095Dum02#67	I-95 SB On ramp from Dumfries Rd	Merge	70	27	F	19	54	B
MGS095Dum03#69	I-95 SB On ramp from HOV/HOT SB s/o Dumfries Rd	Merge	83	19	F	N/A	N/A	N/A
DGS095Jop01#71	I-95 SB Off ramp to Joplin Rd WB	Diverge	32	51	D	18	56	B
DGS095Jop02#72	I-95 SB Off ramp to Joplin Rd EB	Diverge	37	49	E	24	57	C
MGS095Jop01#74	I-95 SB On ramp from Joplin Rd	Merge	89	19	F	20	60	B
DGS095Rus01#76	I-95 SB Off ramp to Russell Rd	Diverge	87	21	F	25	55	C
MGS095Rus01#78	I-95 SB On ramp from Russell Rd	Merge	66	31	F	26	55	C
MGS095Gar01#76	I-95 SB On Ramp from HOV/HOT n/o Garrinsonville Rd	Merge	N/A	N/A	N/A	49	38	F
DGS095Gar01#80	I-95 SB Off ramp to Garrinsonville Rd	Diverge	54	38	F	63	28	F
MGS095Gar01#84	I-95 SB On ramp from Garrinsonville Rd	Merge	22	58	C	21	57	C

9.3.3.6 Intersection Analysis

AM Peak

Exhibit 9-30 is a summary of the projected intersection LOS results for the AM peak hour for the 2035 No-Build and Build scenarios. The percentage of intersections operating at LOS E and F in the No-Build and Build scenarios is very similar, with only one to three percent difference between the scenarios.

Exhibit 9-30: Intersection LOS Summary for 2035 AM No-Build and Build Scenarios



Arterials that intersect the I-95 corridor were analyzed between the 2035 No Build and Build scenarios. Overall demand on arterials (total entering volume including freeway ramps and adjacent intersections) is projected to experience a slight increase of less than 2 percent with the project.

In general, arterial operations are similar between the 2035 No Build and Build scenarios. At a few locations, increased demand contributes to increased intersection delay in the 2035 Build scenario. At the I-495/Braddock Road interchange, arterial intersections operate at LOS F in both the 2035 No Build and Build scenario, although intersection delay increases by approximately 30 percent with the Build scenario.

Intersections on the west side of the Fairfax County Parkway intersection experience higher delays in the Build scenario because of the change in intersection operations and traffic demand at the Alban Road/Boudinot Road/I-95 HOT ramp terminal intersection. That intersection, as well as the two adjacent intersections at Boudinot Road/Fullerton Road and Backlick Road/Fullerton Road, operates at LOS E in the Build scenario, compared to LOS D or better in the No Build scenario.

Lorton Road/Silverbrook Road degrades from LOS E in the No Build scenario to LOS F in the Build scenario because of downstream impacts at the Lorton Road/I-95 southbound ramp terminal eastbound left-turn movement.

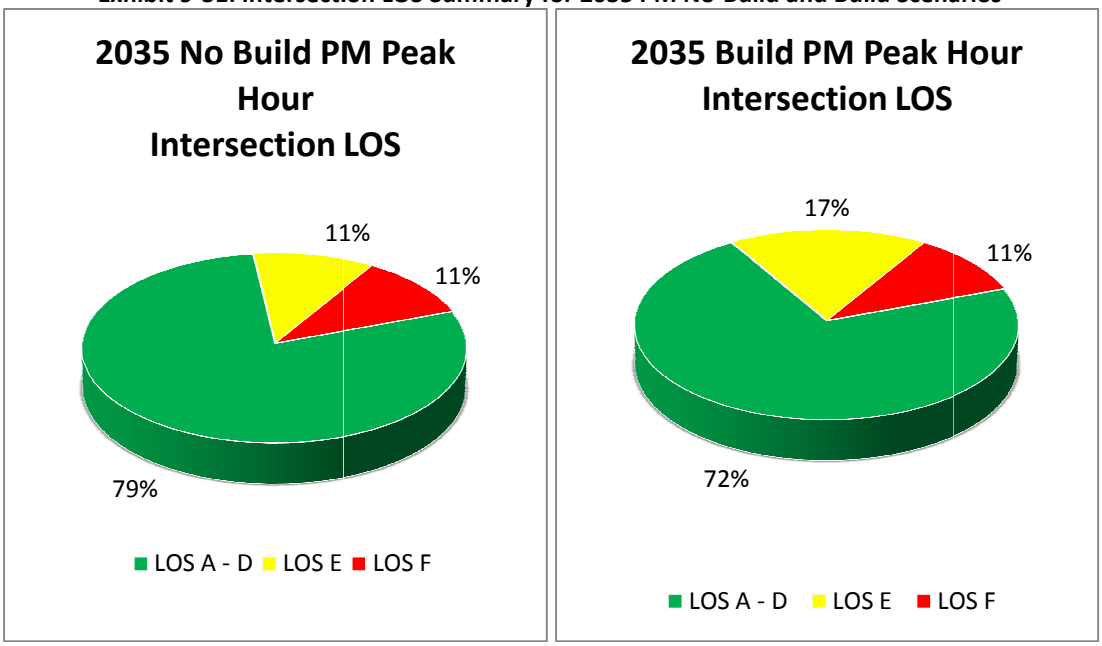
At the Gordon Boulevard/I-95 interchange, the two adjacent intersections to the west of I-95 degrade from LOS D or better in the 2035 No Build scenario to LOS E in the 2035 Build scenario. The degradation is caused by increased demand in the Build scenario (12 to 15 percent higher than the No Build scenario).

At the Joplin Road/I-95 interchange, demand is projected to decrease by 10 percent, which causes the intersection LOS to improve from LOS F in the 2035 No Build scenario to LOS D in the 2035 Build scenario.

PM Peak

Exhibit 9-31 is a summary of the projected intersection LOS results for the PM peak hour for the 2035 Build and No-Build scenarios. There is slight reduction of the percentage of intersections operating at LOS F in the Build scenario and the total percentage of intersections under LOS E increases from 11 to 17 percent. The main reason for LOS degradation is due to the travel demand increase in the Build scenario.

Exhibit 9-31: Intersection LOS Summary for 2035 PM No-Build and Build Scenarios



There are eight intersections that are projected to operate at LOS F in the 2035 No-Build scenario. The I-95 southbound off-ramp/Russell Road intersection improves to LOS E in the Build scenario. The remaining seven intersections operating at LOS F in the No-Build scenario will continue to operate at LOS F in the Build scenario.

There are six intersections where the projected operations degrade from LOS C or D in the No-Build scenario to LOS E in the Build scenario. All other intersections operate at adequate LOS A to D both in the 2035 No-Build and 2035 Build scenarios.

9.3.3.7 Summary

AM Peak

Table 9-38 is a summary of the measures of effectiveness used in the analysis and comparison of scenarios. Overall, the 2035 AM Build scenario typically operates slightly better than the No-Build scenario, as shown by the following metrics:

- No change in overall corridor travel time
- Same number of bottlenecks
- Improved throughput and percent of vehicles served along the I-95 corridor
- Slightly improved traffic operations (lower density and better LOS) at some freeway segments
- No significant degradation in intersection operations

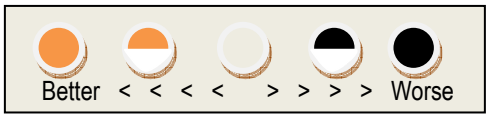
Below are the key operational highlights of the proposed project in the 2035 AM peak hour:

- As highlighted in section 9.3.3.1, traffic demand is expected to increase in the peak northbound direction comparing the Build and No-Build scenarios. The capacity increase of the HOV/HOT lanes and permitting toll-paying vehicles on the facility contribute to the increased attractiveness of the I-95 corridor. All existing HOV/HOT direct connect ramps to arterial facilities will have a significant increase in vehicle demand. Arterials in general should have a small volume increase due to the proposed modifications in the Build scenario.
- Along northbound I-95 in the GP lanes, travel times are expected to be similar between the No-Build and Build scenarios in the segment from Garrisonville Road to Edsall Road. Even with the large increase in vehicle demand along the HOV/HOT lanes, travel times between Garrisonville Road and I-495 are expected to be approximately the same between the No-Build and Build scenario. An HOV (3+) and toll-paying driver can expect to save approximately 11 minutes traveling between Garrisonville Road and Duke Street. This improvement is due to the proposed extension of the HOV/HOT facility.
- Travel time in the vicinity of the Northern Terminus between Edsall Road and Duke Street will increase slightly in the Build scenario, due to a slight increase in GP lane demand. The Northern Terminus is studied in more detail in Section 9.3.4.
- In the 2035 Build AM peak hour, all segments of northbound I-95 (GP and HOV/HOT lanes) are able to serve more vehicles than the No-Build scenario. Moreover, the percent unserved, that is the number of vehicles that cannot access the corridor but desire to, is lower through most segments.
- Although the project is expected to attract more vehicle demand than the No-Build scenario, upstream and downstream corridor impacts are expected to be negligible to minor. Vehicles traversing arterials and intersections adjacent to the facility are expected to see a small increase in travel time and average delay.

- Of the six weave segments common to both the 2035 No Build and Build scenarios, only one segment is expected to degrade in operations (I-95 northbound GP lanes between Gordon Boulevard southbound on-ramp and northbound off-ramp), with a change from in HCM-Equivalent LOS from D to E, and a marginal decrease in speed from 42 mph to 40 mph . There are two new weave segments created in the 2035 Build scenario, with only one segment experiencing severe congestion, representing an HCM-Equivalent LOS F. (in the Northern Terminus vicinity between the Turkeycock HOT exit ramp and the Duke Street eastbound off-ramp). However, the severe congestion experienced in this segment is not necessarily attributed to project impacts, but rather due to downstream bottlenecks on I-395 north of the study area. As such, the proportion of weave segments at LOS E and F change from 30% in the No-Build to 50% in the Build, as see in Table 9-38; although this appears to be a significant change between scenarios, it is actually a change from D to E for one weave and one additional new weave showing LOS F. (There are only six weave segments identified in the No-Build scenario.) A detailed analysis and discussion of the operational elements of the segment encompassing the Northern Terminus, as well as mitigation options to improve operational performance, is discussed later in this chapter to address the issues related to the LOS F for this new weave segment. As will be discussed later, certain mitigation options downstream of the HOT Lanes Northern terminus have the potential to address queuing and spillback congestion to the north for all scenarios, as well as to improve the overall performance of the Build scenario, and specifically the operational characteristics of the HOT flyover ramp merge at the Northern Terminus.

Table 9-38: Overall Performance Comparison for 2035 AM No-Build and Build

			2035 AM No Build Value	2035 AM Build Value	Project Performance
Travel Time GP	Measured for the entire corridor in the peak, northbound direction	Minutes	**38.5**	**39.0**	
Travel Time HOV/HOT	Measured from Garrisonville Road to Duke Street. Southern portion of HOV trip in No-Build from Garrisonville to Dumfries is measured on the GP lanes	Minutes	**27.0**	**27.0**	
Average Speed	Average for all measures taken every 0.5 mile and every 15-minute intervals along the corridor and in the peak direction	mph	**53**	**53**	
Number of main Bottlenecks	Locations along the corridor in the peak direction where traffic volumes are heavily constrained generating upstream congestion	Number	**1**	**1**	
Average Volume Throughput	Average for all measures taken at screenline locations along the corridor and in the peak direction. Includes both GP and HOV/HOT volumes	Veh/hr	**7,500**	**8,700**	
Average Un-served Demand	Average for all measures taken at screenline locations along the corridor and in the peak direction. Includes both GP and HOV/HOT Demand	%	**11**	**9**	
Intersections at LOS E and F	Summary for all intersections within the study area	%	**23**	**24**	
Basic Freeway Segments at LOS E and F	Summary for all basic segments along the corridor and in the peak direction	%	**21**	**22**	
Weave Segments at LOS E and F	Summary for all weaving segments along the corridor and in the peak direction	%	**33**	**50**	
Ramp Junctions at LOS E and F	Summary for all merge and diverge segments along the corridor and in the peak direction	%	**24**	**19**	



PM Peak

Table 9-39 is a summary of the measures of effectiveness used in the analysis and comparison of scenarios. Overall, the 2035 PM Build scenario typically operates better than the No-Build scenario, as shown by the following metrics:

- Decrease in overall corridor travel time
- Reduction or elimination of several bottlenecks
- Improved throughput and percent of vehicles served along the I-95 corridor
- Improved traffic operations (lower density and better LOS) at some freeway segments

Intersection operations are the only component in the roadway network that is projected to degrade slightly in the Build condition due to an increase in travel demand.

Below are the key operational highlights of the proposed project in the 2035 PM peak hour:

- As highlighted in section 9.3.3.1, traffic demand is expected to increase in the peak southbound direction comparing the Build and No-Build scenarios. The capacity increase of the HOV/HOT lanes and permitting toll-paying vehicles on the facility contribute to the increased attractiveness of the I-95 corridor. All existing HOV/HOT direct connect ramps to arterial facilities will have a significant increase in vehicle demand. Arterials in general should have a small volume increase due to the proposed modifications in the Build scenario.
- Along southbound I-95 in the GP lanes, travel times are expected to decrease by approximately 10 minutes in the Build scenario (compared to the No-Build scenario) in the section from Duke Street to Garrisonville Road. Even with the large increase in vehicle demand along the HOV/HOT lanes, travel times between Duke Street and the existing southern terminus at Dumfries Road) are expected to be approximately the same between the No-Build and Build scenario. An HOV (3+) driver can expect to save up to 10 minutes traveling between Duke Street and Garrisonville Road. This improvement is due to the proposed extension of the HOV/HOT facility and the elimination of the mainline congestion between Dumfries Road and Garrisonville Road.
- The southernmost bottleneck between Dumfries Road and Garrisonville Road is projected to be eliminated with the completion of the Build scenario. The duration, intensity, and length of the queues associated with two other bottlenecks will be reduced. Travel speeds through each of the bottlenecks will be faster under the Build scenario. Speeds along the HOV/HOT lanes should be comparable between the No-Build and Build scenarios.
- In the 2035 Build PM peak hour, all segments of southbound I-95 (GP and HOV/HOT lanes) are able to serve more vehicles than the No-Build scenario. Moreover, the percent unserved, that is the number of vehicles that cannot access the corridor but desire to, is lower through most segments.
- Although the project is expected to attract more vehicle demand than the No-Build scenario, upstream and downstream corridor impacts are expected to be negligible to minor. Vehicles traversing arterials and intersections adjacent to the facility are expected to see a small increase in travel time and average delay.

Table 9-39: Overall Performance Comparison for 2035 PM No-Build and Build

Measure of Effectiveness	Description	Units	2035PM No Build Value	2035 PM Build Value	Build Performance compared to No-Build
Travel Time GP	Measured for the entire corridor in the peak, southbound direction	Minutes	54.9	45.1	
Travel Time HOV/HOT	Measured from Duke Street to Garrisonville Road. Southern portion of HOV trip in No-Build from Dumfries to Garrisonville is measured on the GP lanes	Minutes	37.9	27.1	
Average Speed	Average for all measures taken every 0.5 mile and every 15-minute intervals along the corridor and in the peak direction	mph	48	52	
Number of main Bottlenecks	Locations along the corridor in the peak direction where traffic volumes are heavily constrained generating upstream congestion	Number	3	2	
Average Volume Throughput	Average for all measures taken at screenline locations along the corridor and in the peak direction. Includes both GP and HOV/HOT volumes	Veh/hr	7,800	9,050	
Average Un-served Demand	Average for all measures taken at screenline locations along the corridor and in the peak direction. Includes both GP and HOV/HOT Demand	%	15	11	
Intersections at LOS F	Summary for all intersections within the study area	%	11	11	
Intersections at LOS E	Summary for all intersections within the study area	%	11	17	
Basic Segments LOS E-F	Summary for all basic segments along the corridor and in the peak direction	%	49	29	
Weave Segment LOS E-F	Summary for all weaving segments along the corridor and in the peak direction	%	67	60	
Ramp Junctions LOS E-F	Summary for all merge and diverge segments along the corridor and in the peak direction	%	45	28	

9.3.4 Microsimulation Summary and Recommendations

9.3.4.1 Overall I-95 Corridor

The traffic analysis performed through microsimulation and summarized in this chapter clearly shows that overall (AM/PM peak hours in both 2018 and 2035), the I-95 corridor will operate better in the Build scenario. This statement is supported by improvements in travel times, average speeds, freeway densities, throughput volumes, and percent of demand served. The overall performance tables (Table 9-24, 9-25, 9-38, and 9-39) show that the majority of the MOE's used in this analysis show significantly improvement or no impact for the Build scenario compared to the No-Build.

The following elements are the only ones that show degradation in the operation for the Build scenario:

- **Weave segment density for the 2035 AM Build scenario**: one segment is expected to degrade in operations (I-95 northbound GP lanes between Gordon Boulevard southbound on-ramp and northbound off-ramp). In addition, there are two new weave segments created in the 2035 Build scenario, with only one segment experiencing severe congestion (in the Northern Terminus vicinity between the Turkeycock HOT exit ramp and the Duke Street eastbound off-ramp). However, the severe congestion experienced in this segment is not necessarily attributed to project impacts, but rather due to downstream bottlenecks on I-395 north of the study area. Additional mitigation measures are proposed for the Northern Terminus area. These are described in Section 9.3.4.2.
- **Intersection levels of service for the 2018 and 2035 PM Build scenarios**: while most intersections will remain at similar or have better LOS in these Build scenarios, in 2035 there is a seven percent increase in the number of intersections that will operate at LOS E and will otherwise operate at LOS D or better in the No-Build scenario. The intersections are listed below:
    1. Braddock Rd & Port Royal Rd
    2. Braddock Rd & I-495 HOT Lanes
    3. Franconia Rd & Commerce St/Loisdale Rd
    4. Loisdale Rd & Newington Rd
    5. Gordon Blvd & Old Bridge Rd
    6. Prince William Pkwy & I-95 SB On Ramp
    7. Prince William Pkwy & Summerland Dr/York Dr

This degradation is due to higher demand as well as changes in the traffic patterns that affect individual movements and cause additional delay in some intersection approaches. Similarly, in 2018, the number of intersections operating at LOS E or LOS F is expected to increase from 11 in the No-Build scenario to 18 in the Build scenario. The intersections are listed below:

1. Franconia Rd & Commerce St/Loisdale Rd
2. Franconia Springfield Pkwy WB & Frontier Dr
3. Boudinot Dr & Fullerton Rd
4. Fairfax County Pkwy & Terminal Rd
5. Gordon Blvd & Old Bridge Rd
6. Gordon Blvd & Devils Reach Rd
7. Dumfries Rd & Park and Ride

9.3.4.2 HOT Lanes Northern Terminus

Introduction

The Northern Terminus of the I-95 HOV/HOT lanes is currently proposed to be located at the Turkeycock HOV ramps, just north of the Edsall Road interchange with I-395. Under Existing Conditions and all future No Build scenarios, this location only provides an entrance ramp into the HOV/HOT lane facility. The HOV lane facility is restricted to vehicles with 3 or more occupants from 6:00-9:00 AM. Outside of this time period, it is open to all vehicle types. Under the Build scenario, any vehicles traveling northbound in the HOV/HOT lane facility at this location that do not have 3 or more occupants must exit at a new HOT exit ramp that would connect to the I-395 GP lanes between Edsall Road and Duke Street.

In order to analyze the impacts of the Northern Terminus, a sub-area VISSIM model was developed for this vicinity. The Northern Terminus VISSIM model includes the I-395 NB GP and HOV/HOT segments between the I-495 northbound on-ramps to the Seminary Road northbound off-ramp (see **Exhibit 9-32**). The Northern Terminus VISSIM model network geometry was created from the I-95 Corridor VISSIM model. The northbound AM peak period conditions and HOV/HOT lane facility configuration were only modeled in the sub-area model. The simulation period was expanded from the single-hour of 7:00-8:00 AM in the I-95 Corridor model to include an uncongested simulation start and end time of 6:00-10:00 AM.

Exhibit 9-32: Northern Terminus VISSIM Study Area

Travel Demand Forecasts

Travel demand for the Northern Terminus model was developed for a 4-hour period (6:00-10:00 AM). I-395 northbound demand, north of Duke Street, are presented in **Table 9-40** for years 2011 Existing and 2018 Year of Opening. **Table 9-41** presents a comparison of Existing and Design Year 2035.

As shown in the Tables 9-40 and 9-41, total demand in the northbound direction (combining the GP lanes and HOV/HOT lane facility) is projected to increase in both 2018 and 2035 No Build scenarios compared to the Existing because of background growth. Demand is projected to increase in the Build scenario compared to the No Build scenario as well. This is the result of additional toll demand being priced out of the HOV/HOT lane facility south of the I-495 interchange in order to keep the maximum exiting hourly rate at Turkeycock to not exceed 1,100 vph. The HOV demand in the Build scenario is slightly higher than the No Build scenario because of a new HOV connection at the Seminary Road interchange constructed as part of the Mark Center project. A complete set of 4-hour demand for all scenarios is contained in **Appendix D**.

Table 9-40: Northern Terminus – Existing 2011 and Year of Opening 2018 Demand north of Duke Street

Start Time of Hour	2011 Existing				2018 No Build				2018 Build			
	GP & Truck	HOV3+	Toll	Total	GP & Truck	HOV3+	Toll	Total	GP & Truck	HOV3+	Toll	Total
6:00 AM	6290	2765	0	9055	6280	2844	0	9124	5629	2912	776	9318
7:00 AM	6405	2905	0	9310	6470	2930	0	9400	5800	3000	800	9600
8:00 AM	5500	1995	0	7495	6280	2844	0	9124	5629	2912	776	9318
9:00 AM	3300	2100	0	5400	3451	2361	0	5812	3094	2417	645	6156
4-HR Total =	*21495*	*9765*	*0*	*31260*	*22481*	*10979*	*0*	*33459*	*20153*	*11241*	*2998*	*34391*
					Growth over Existing =			7.0%	*Growth over Existing =*			10.0%

Table 9-41: Northern Terminus – Existing 2011 and Design Year 2035 Demand north of Duke Street

Start Time of Hour	2011 Existing				2035 No Build				2035 Build			
	GP & Truck	HOV3+	Toll	Total	GP & Truck	HOV3+	Toll	Total	GP & Truck	HOV3+	Toll	Total
6:00 AM	6290	2765	0	9055	6406	3067	0	9473	5537	3164	1014	9716
7:00 AM	6405	2905	0	9310	6600	3160	0	9760	5705	3260	1045	10010
8:00 AM	5500	1995	0	7495	6406	3067	0	9473	5537	3164	1014	9716
9:00 AM	3300	2100	0	5400	3521	2546	0	6067	3043	2627	842	6512
4-HR Total =	*21495*	*9765*	*0*	*31260*	*22932*	*11840*	*0*	*34773*	*19823*	*12215*	*3916*	*35953*
					Growth over Existing =			11.2%	*Growth over Existing =*			15.0%

Existing Conditions

Existing Conditions were analyzed with the Northern Terminus VISSIM model to ensure consistency with measured field data, as well as results from the I-95 Corridor VISSIM model. The Northern Terminus model was calibrated to MOE'sinclude including travel time, throughput volume, temporal speed diagrams, and observed queue.

Exhibit 9-33 shows a travel time comparison between field data and VISSIM model output. Travel time along I-395 northbound was measured between the I-495 eastbound bridge, the Edsall Road overpass, and the Duke Street overpass. Travel times from the VISSIM model for each individual segment as well as the sum of both segments was within 15 percent of travel times measured in the field.

Exhibit 9-33: Northern Terminus – Existing 2011 Travel Time comparison (field data vs VISSIM model)

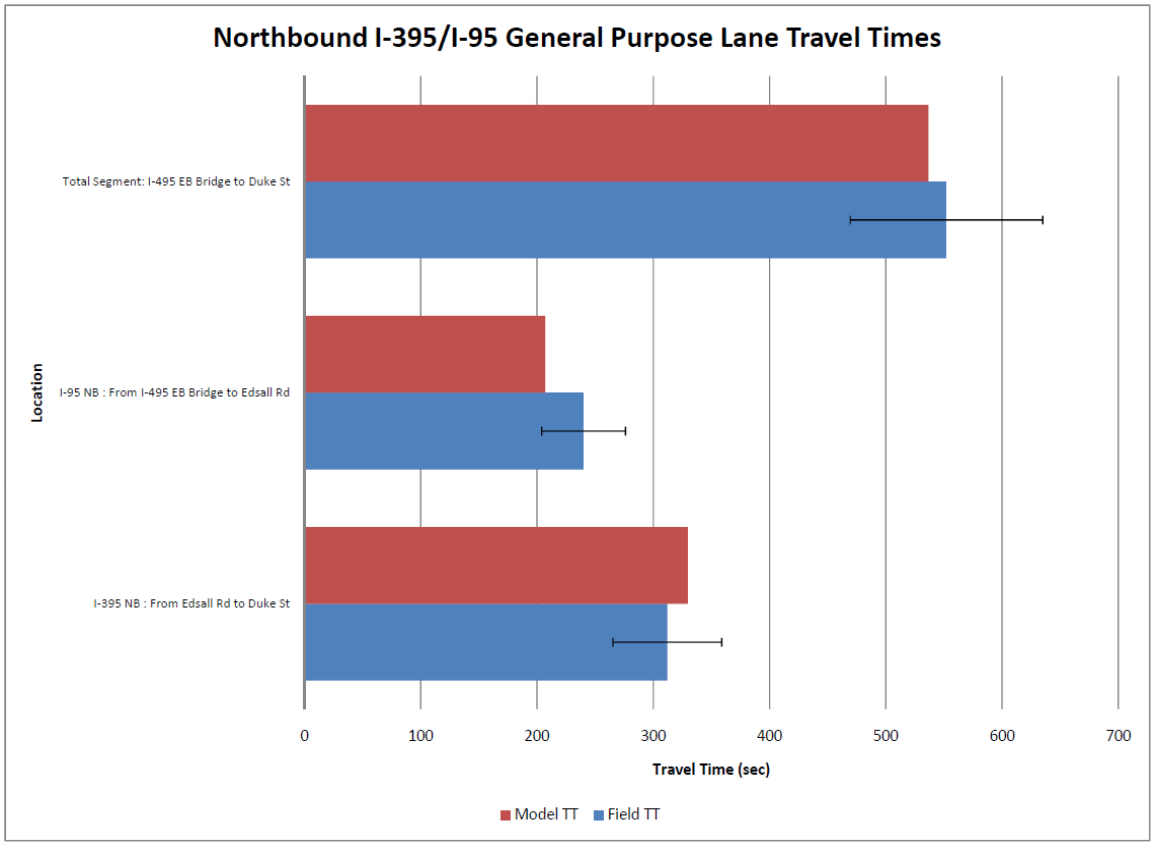


Exhibit 9-34 shows a throughput volume comparison between count and model output on I-395 northbound GP lanes north of Duke Street. At the location where the count was taken (I-395 northbound GP lanes between Duke Street and Seminary Road), congested conditions and queues were observed that are caused by a downstream bottleneck outside of the study area. Because the count location was being constrained by congestion, the demand could not be set equal to the counted volume; otherwise the observed congestion and queues would not be able to be replicated in the VISSIM model. Therefore, existing demand was estimated or "smoothed" (which can also be seen on Exhibit 9-34). At the beginning and end of the simulation, the demand and throughput volumes are almost equal to each other. During the early part of the simulation when queues build up (from 6:30-8:45 AM), the throughput is lower than the demand. During the later part of the simulation (from 8:45-9:45 A) when queues are receding, throughput volume is higher than the demand.

Exhibit 9-35 shows a temporal speed diagram comparison for the I-395 northbound GP lanes between field data (compiled by INRIX) and VISSIM model output. Both the field data and VISSIM model output show similar congestion patterns north of Duke Street, due to a downstream queue that spills back into the study area from approximately 7:45-9:15 AM. A bottleneck also forms between the Duke Street On-ramp and Seminary Road Off-ramp in both the field data and VISSIM model output.

Exhibit 9-34: Northern Terminus – Existing 2011 Throughput volume comparison (field data vs VISSIM model)

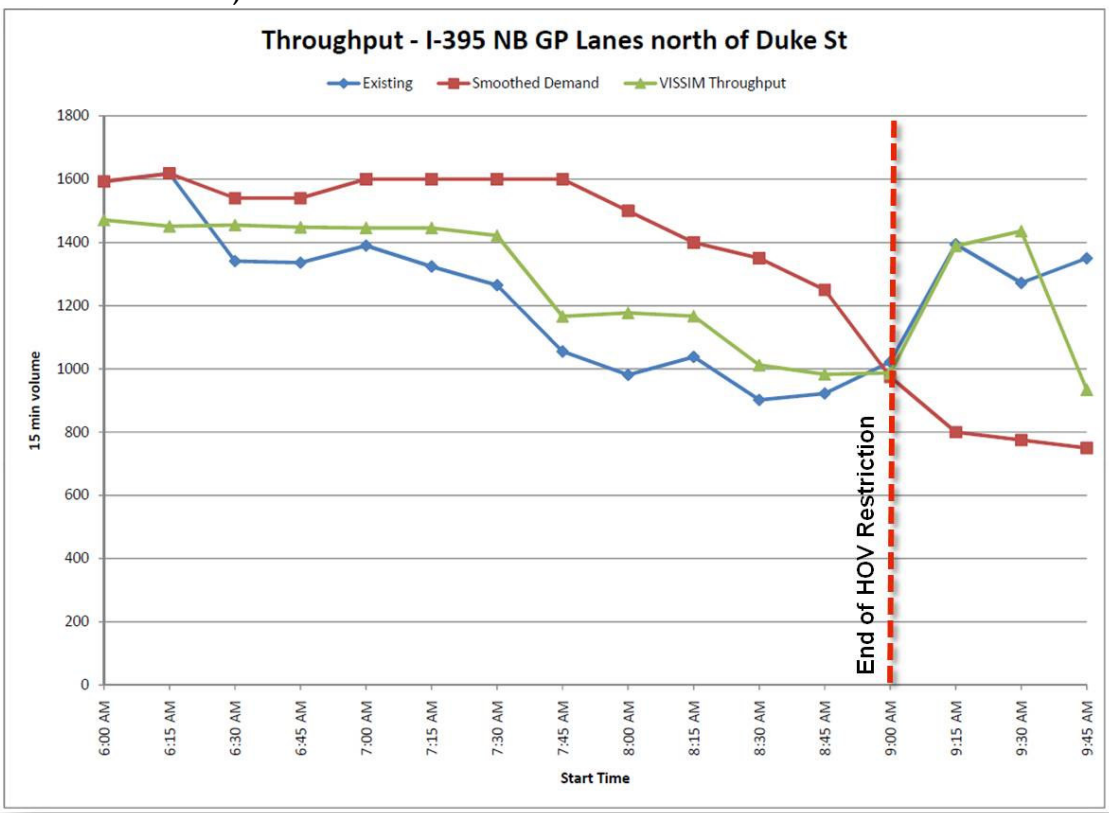


Exhibit 9-35: Northern Terminus – Existing 2011 temporal speed diagram comparison (field data vs VISSIM model)

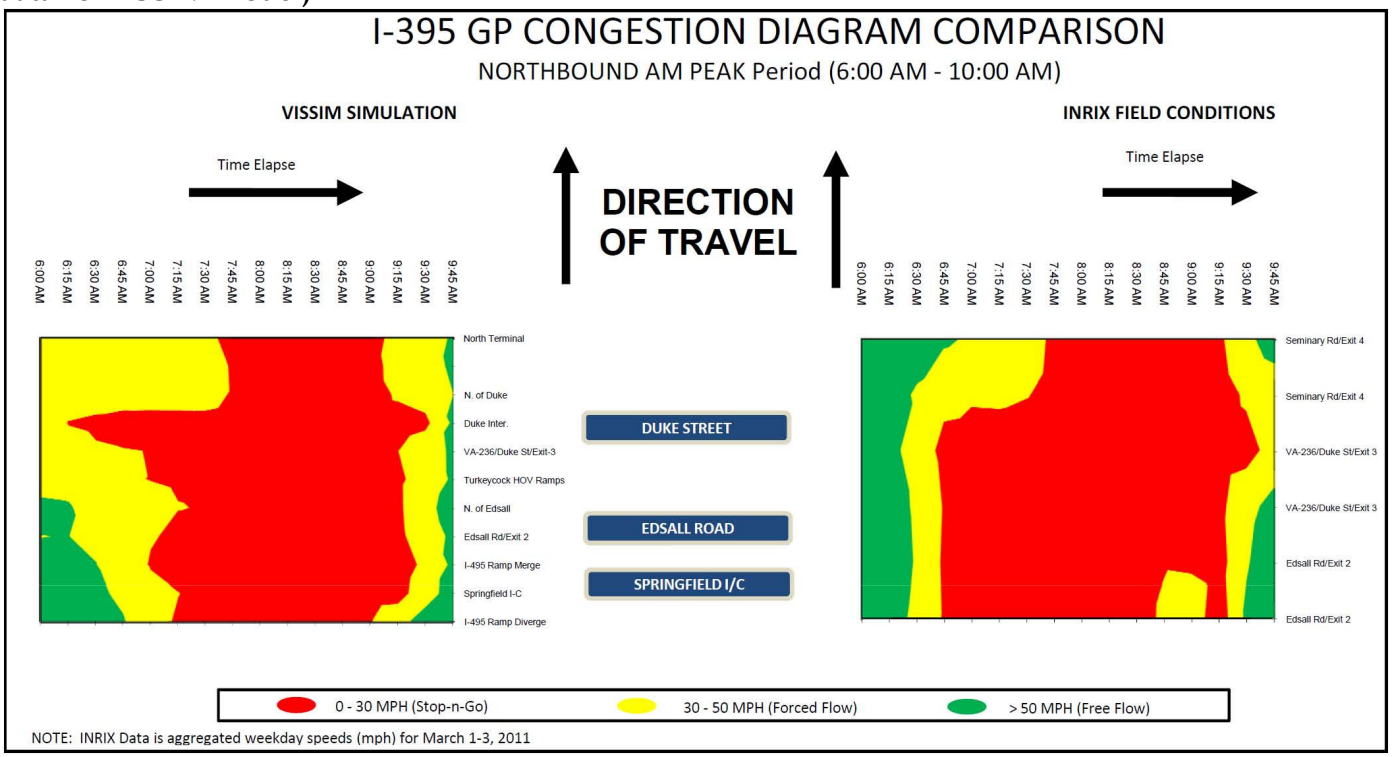
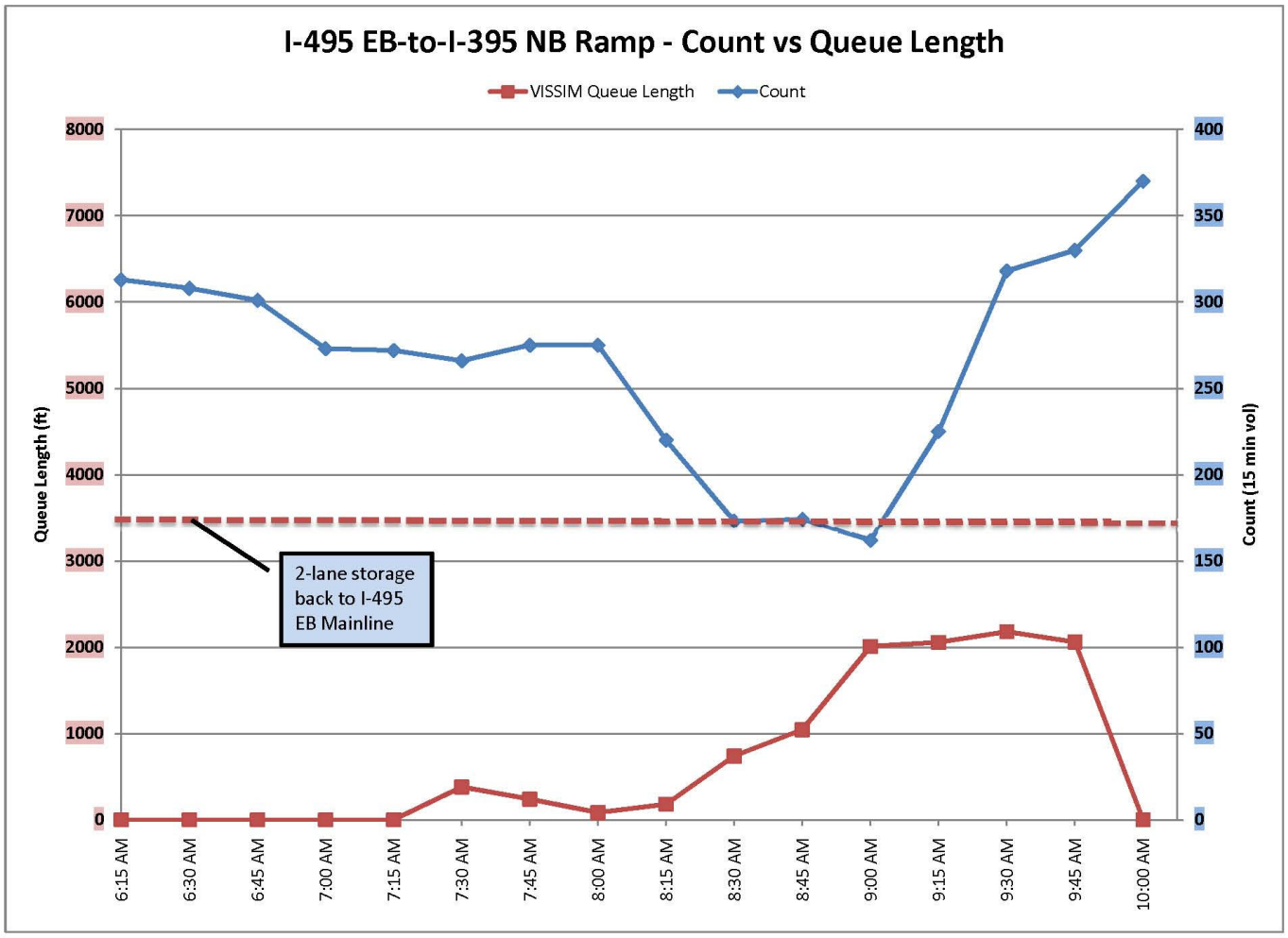


Exhibit 9-36 depicts the queue length on the I-495 eastbound to I-395 northbound ramp compared to the tube count taken at the I-495 Springfield interchange. Based on observations of queues at this interchange, the queue on this ramp does not typically spill back to the I-495 eastbound mainline lanes. The count is constrained from 8:15-9:30 AM, due to congestion on nearby I-395 northbound GP lanes. In the Existing VISSIM model, a queue begins to develop at approximately 8:15 AM on this ramp, due to congestion on the I-395 northbound GP lanes. However, the queue does not spill back to the I-495 eastbound mainline lanes, and recedes by the end of the simulation period.

Exhibit 9-36 : **Northern Terminus – I-495 EB-to-I-395 NB ramp queue length (VISSIM model)**



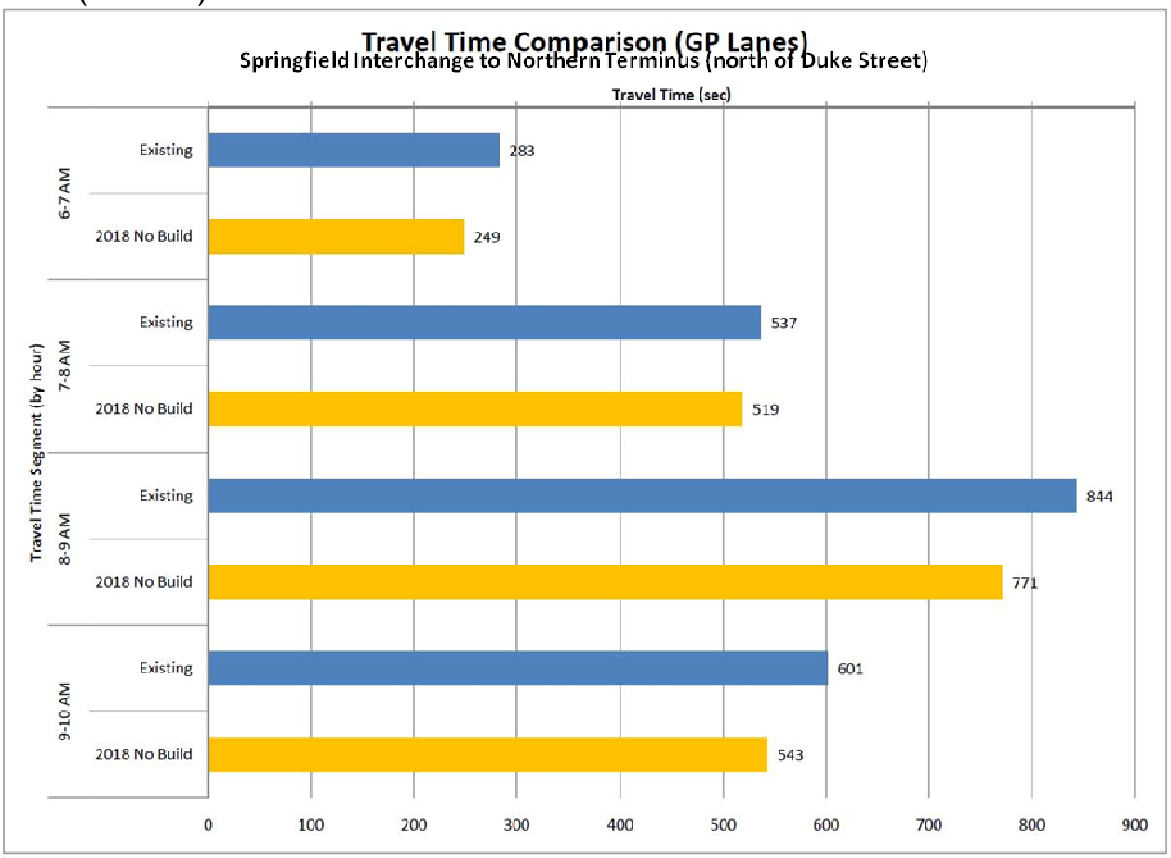
2018 No Build Scenario

Comparisons between Existing Conditions and 2018 No Build are presented for travel time (**Exhibit 9-37**), temporal speed diagrams (**Exhibit 9-38**), and I-495 eastbound to I-395 northbound ramp queue length (**Exhibit 9-39**).

In the 2018 No Build scenario, the HOV lanes would continue to operate with the HOV3+ restriction from 6:00-9:00 AM. Demand north of Duke Street for the 6:00-10:00 AM period is projected to increase by seven percent in 2018 No Build (as shown in **Table 9-40**), although the 7:00-8:00 AM peak hour is only projected to increase by one percent. Demand on northbound I-395 at the I-495 Springfield interchange from 6:00-10:00 AM is the same in 2018 No Build compared to Existing. However, demand coming from the I-495 eastbound ramp to I-395 northbound is projected to increase by 16 percent in 2018 No Build compared to Existing. The growth in demand from this ramp is likely caused by the increased capacity of constructing HOT lanes on the I-495 Beltway. Exhibit 9-39 shows that this ramp is congested for much of the simulation period and would spill back onto I-495 eastbound mainline for approximately 1.5 hours in the AM peak period. Constrained flow on this ramp allows the I-395 NB GP lane travel time to be slightly better in 2018 No Build than Existing. However, when taking into

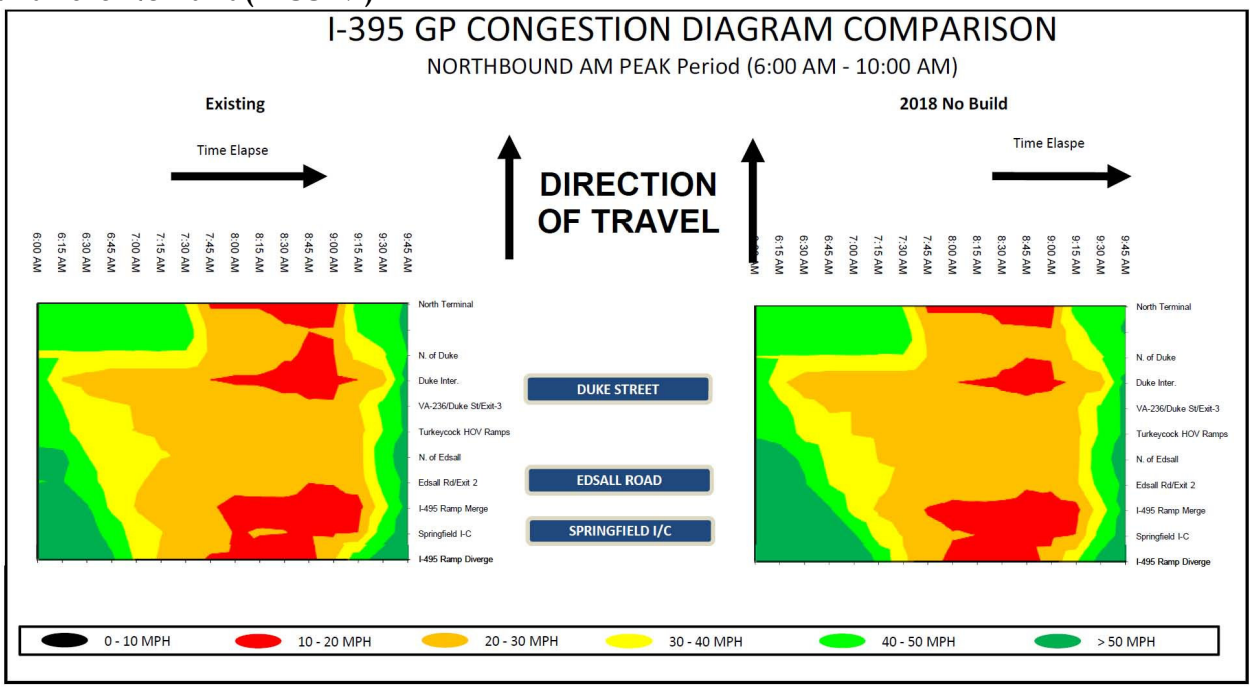
account this ramp and the impacts to the I-495 eastbound mainline, overall system impacts are worse in 2018 No Build.

Exhibit 9-37: Northern Terminus – Travel time comparison between Existing and 2018 No Build (VISSIM)



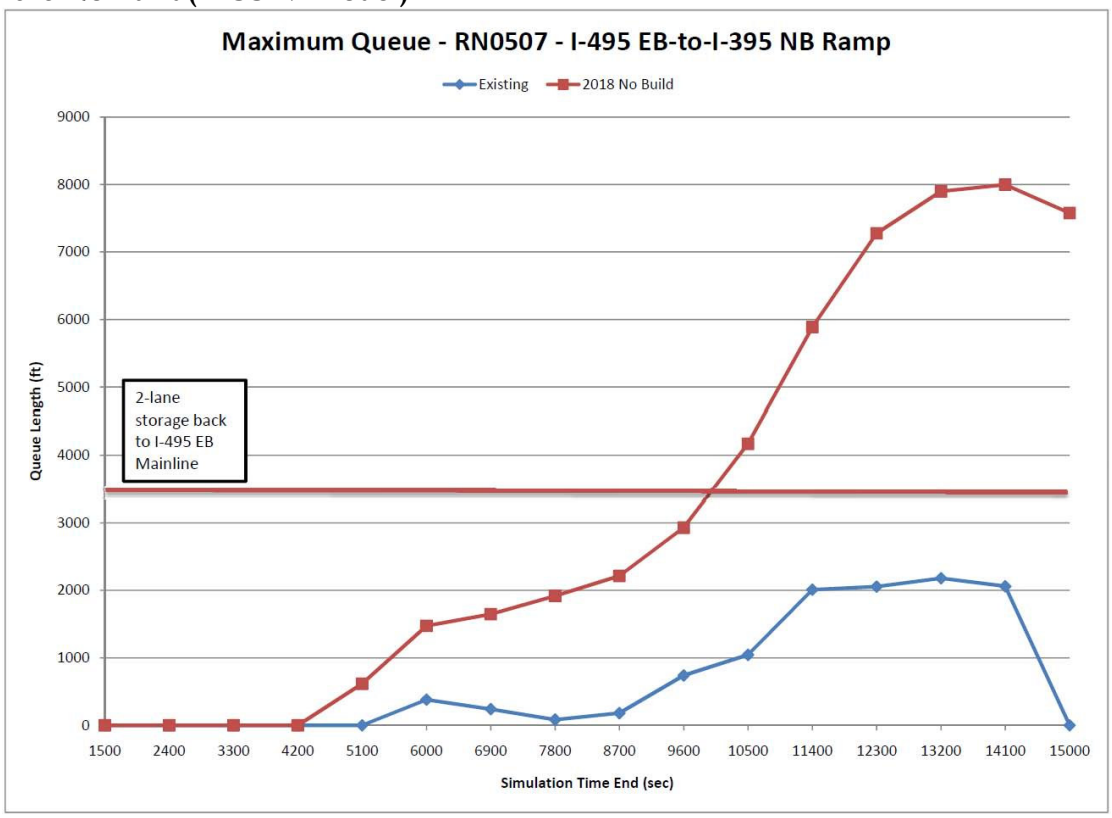
Note: Travel times improve from Existing to 2018 No-Build conditions because the Phase VIII ramps open in the No-Build condition, but are not open in the Existing condition.

Exhibit 9-38: Northern Terminus – Temporal speed diagram comparison between Existing and 2018 No Build(VISSIM)



Note: Travel times improve from Existing to 2018 No-Build conditions because the Phase VIII ramps open in the No-Build condition, but are not open in the Existing condition.

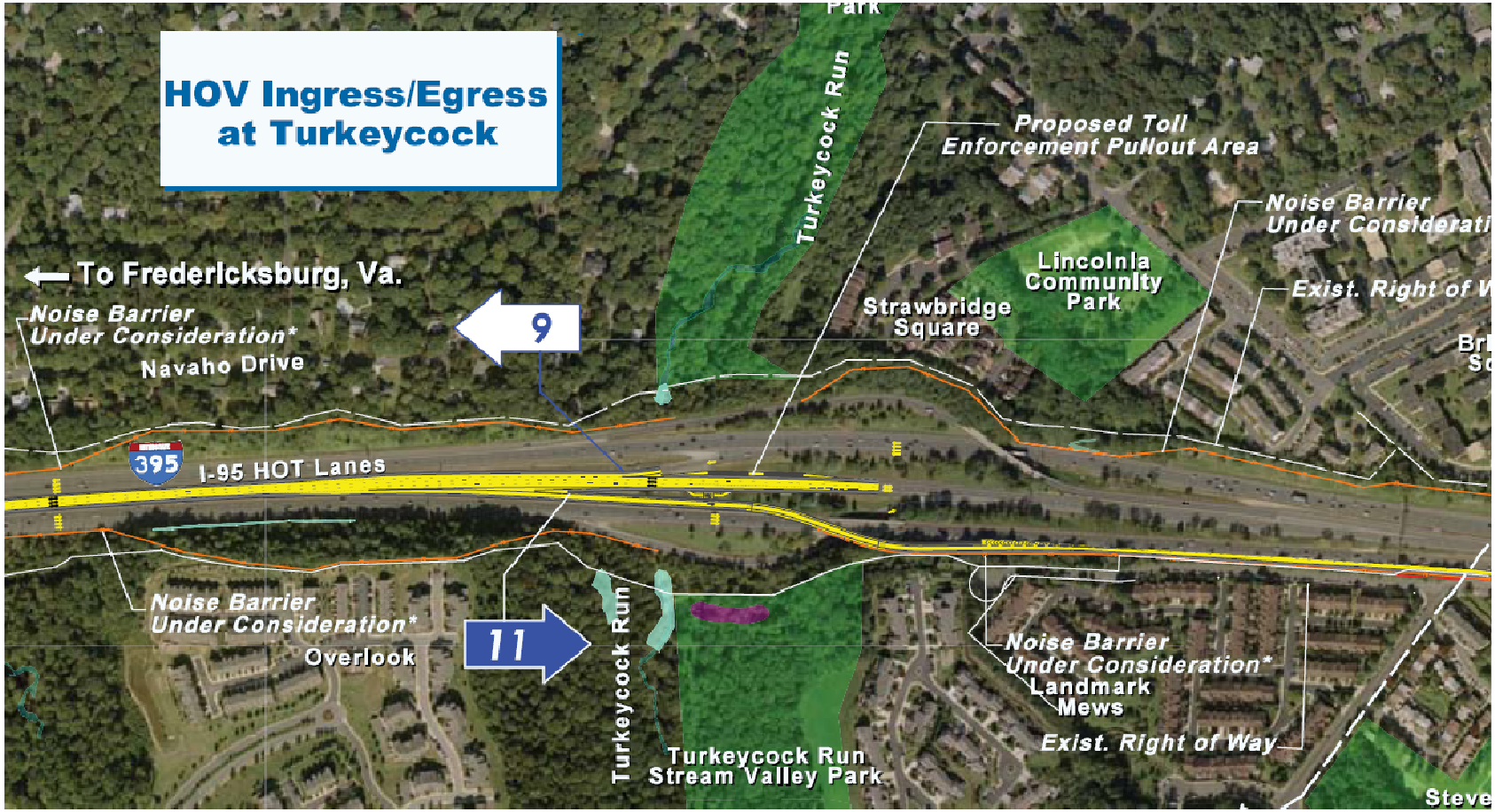
Exhibit 9-39: Northern Terminus – I-495 EB-to-I-395 NB ramp queue length for Existing and 2018 No Build(VISSIM model)



2018 Build "Baseline" Scenario

In the 2018 Build scenario, the I-95 northbound HOV/HOT lane facility would operate as HOT lanes from Fredericksburg to the Turkeycock HOV Exit ramp between Edsall Road and Duke Street. **Exhibit 9-40** shows the proposed configuration of the Turkeycock HOT Flyover Exit ramp. An auxiliary lane would be constructed on northbound I-395 between the flyover ramp and the Duke Street eastbound off-ramp. For comparison purposes to mitigation scenarios presented below, this scenario is referred to as the "Baseline" scenario.

Exhibit 9-40: Northern Terminus – "Baseline" configuration of Northbound I-395 HOV/HOT Exit Ramp at Turkeycock IC



The 2018 Build scenario traffic conditions are compared to the 2018 No Build scenario below for throughput volume on I-395 NB GP lanes north of Duke Street (**Exhibit 9-41**), travel time (**Exhibit 9-42**), temporal speed diagrams (**Exhibit 9-43**), and I-495 eastbound to I-395 northbound ramp queue length (**Exhibit 9-44**).

Demand on northbound I-395, just north of Duke Street, is projected to increase in the 2018 Build scenario by three percent over the 2018 No Build scenario. However, the capacity of northbound I-395 between Duke Street and Seminary Road will be the same between 2018 No Build and Build, as can be seen in the throughput volumes from Exhibit 9-41. In addition to slightly higher demand north of Duke Street, traffic patterns at the I-495 Springfield interchange shift between 2018 No Build and Build because of the HOV/HOT lane operations. The HOV/HOT exit ramp at Turkeycock is projected to have 900 trips in the AM peak hour. These 900 trips that are entering the study area from the uncongested HOV/HOT lanes would have been entering the study area from the northbound I-395 GP lanes in the No Build scenario. This shift in traffic pattern causes the GP lanes upstream of the Turkeycock HOV/HOT exit ramp to experience longer queues, slower speeds, and longer travel time than the No Build scenario. Traffic conditions downstream of the Turkeycock HOV/HOT exit ramp are the same as the No Build scenario.

Exhibit 9-41: Northern Terminus – Throughput volume comparison on I-395 NB GP Lanes north of Duke Street between 2018 No Build and 2018 Build "Baseline" (VISSIM output)

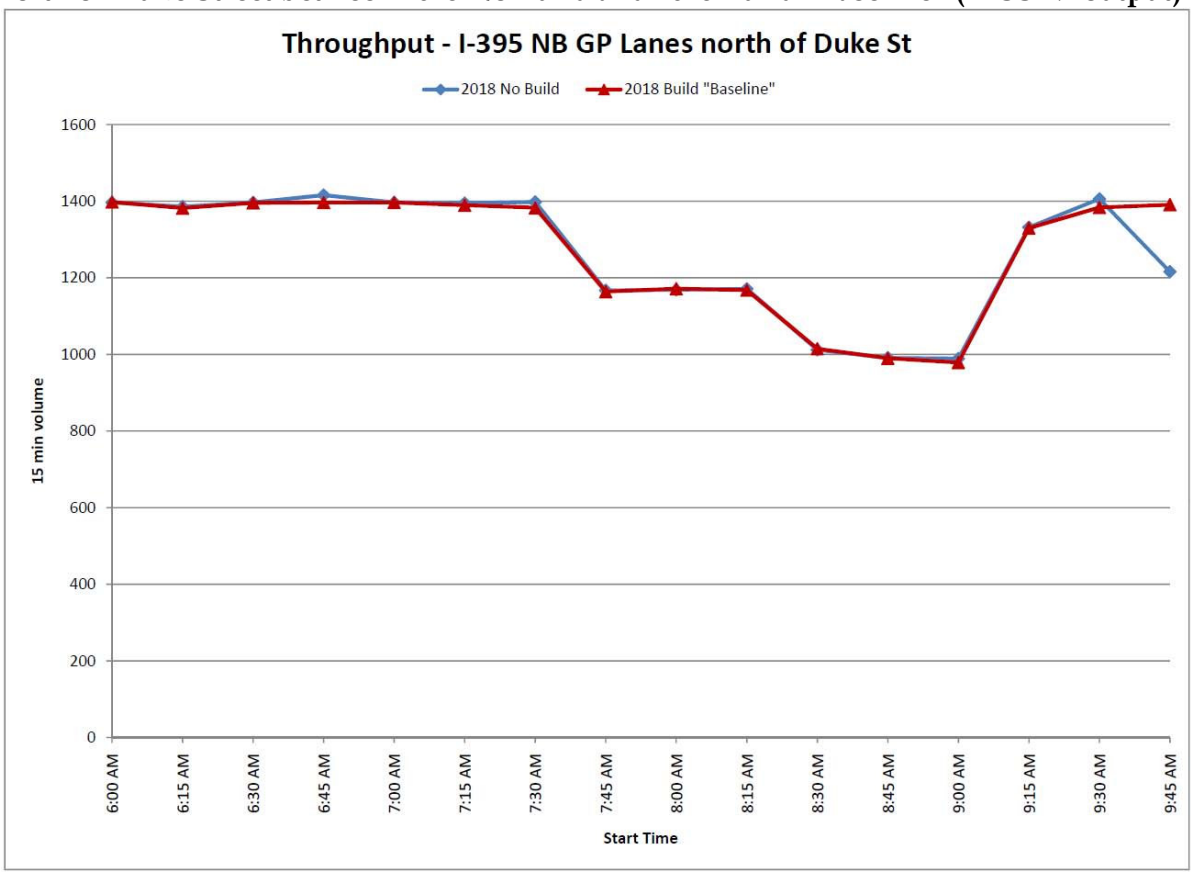
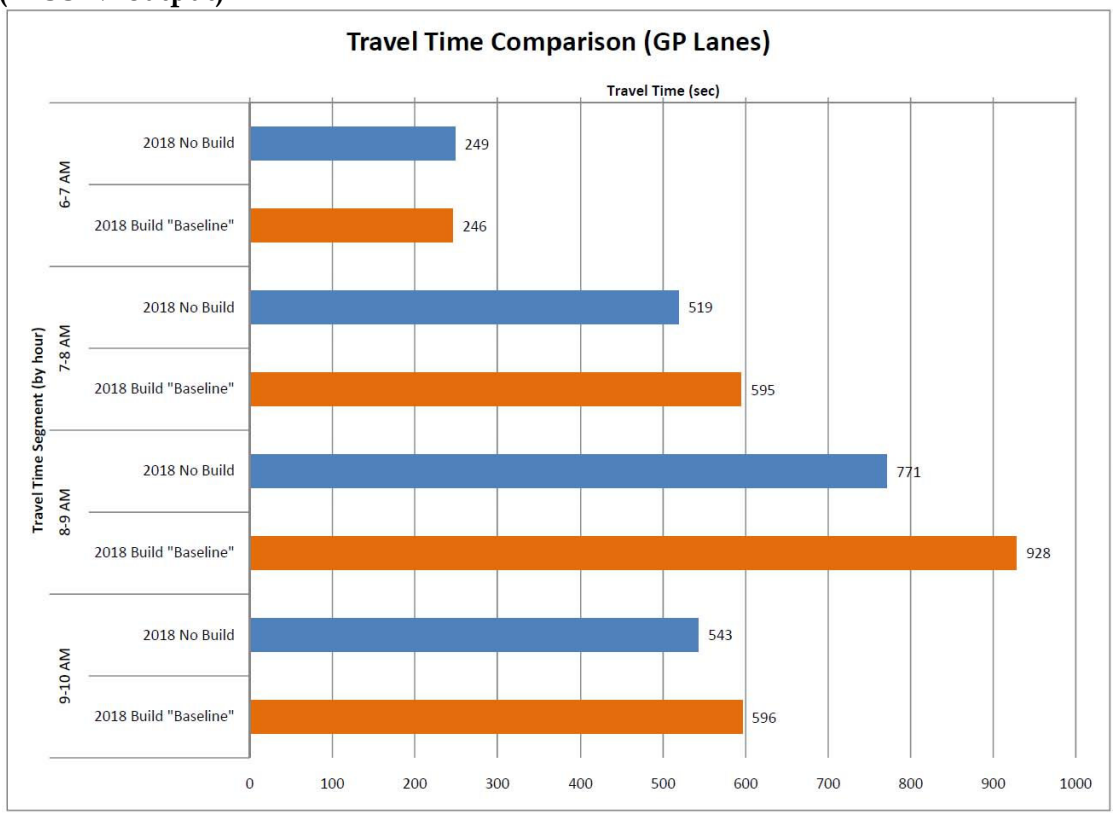


Exhibit 9-42: Northern Terminus – Travel time comparison between 2018 No Build and Build (VISSIM output)



Note: Travel times measured from Springfield Interchange to the Northern Terminus (north of the Duke Street interchange).

Exhibit 9-43: Northern Terminus – Temporal speed diagram comparison between 2018 No Build and Build (VISSIM output)

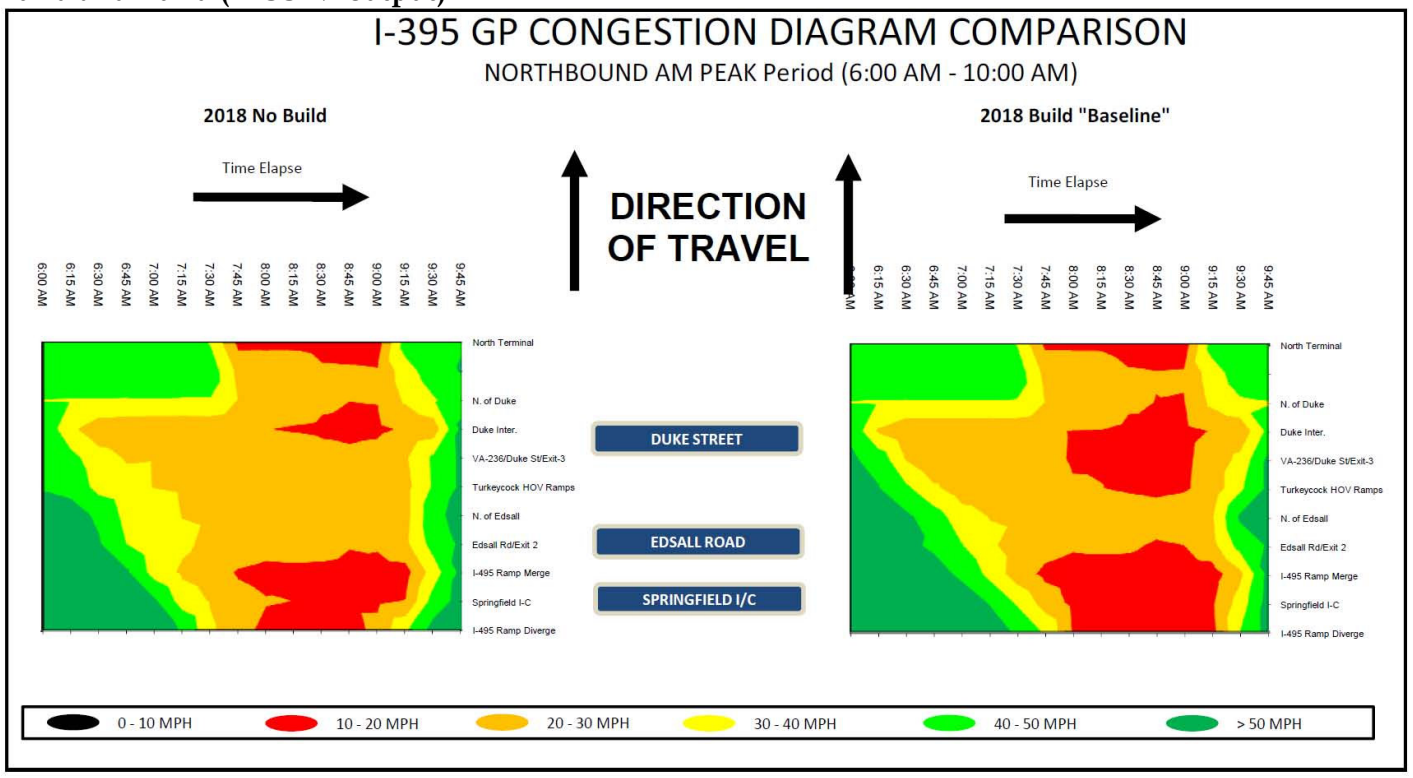
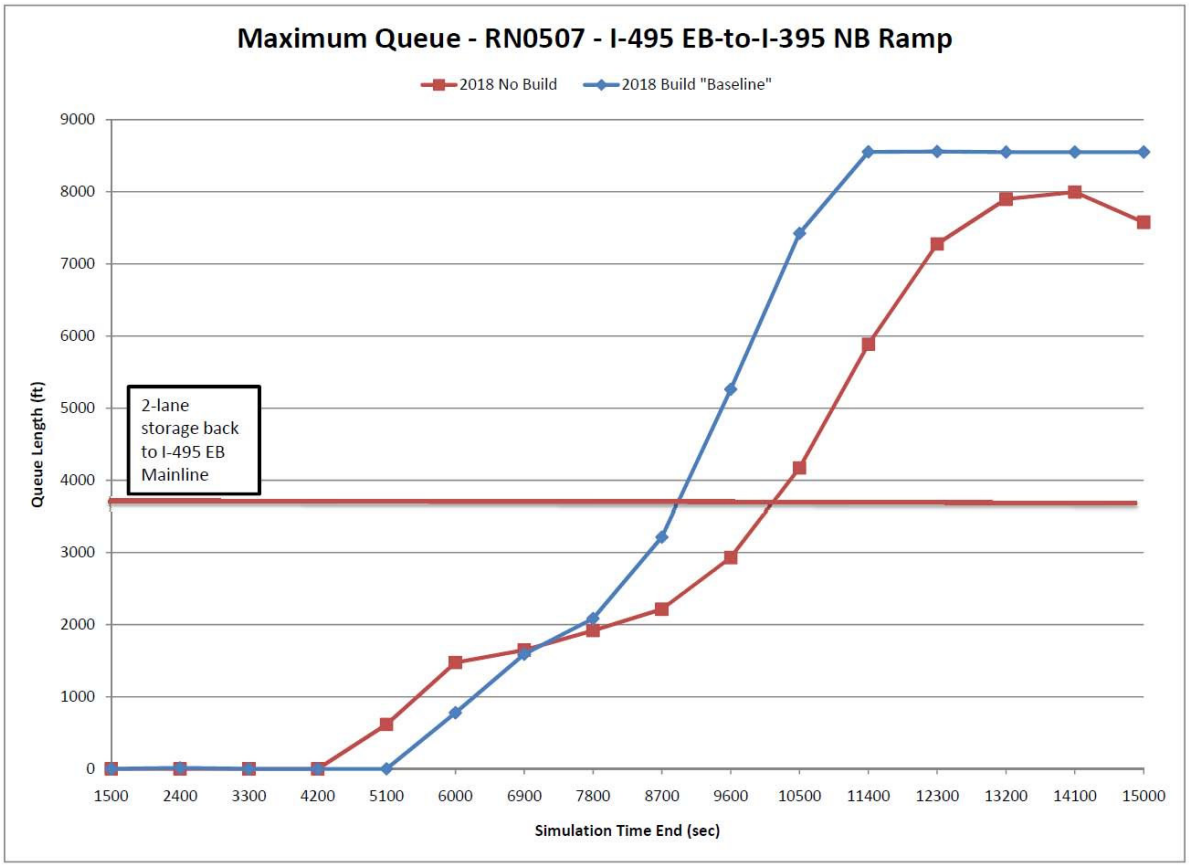


Exhibit 9-44: Northern Terminus – I-495 EB-to-I-395 NB ramp queue length comparison between 2018 No Build and 2018 Build "Baseline" (VISSIM output)



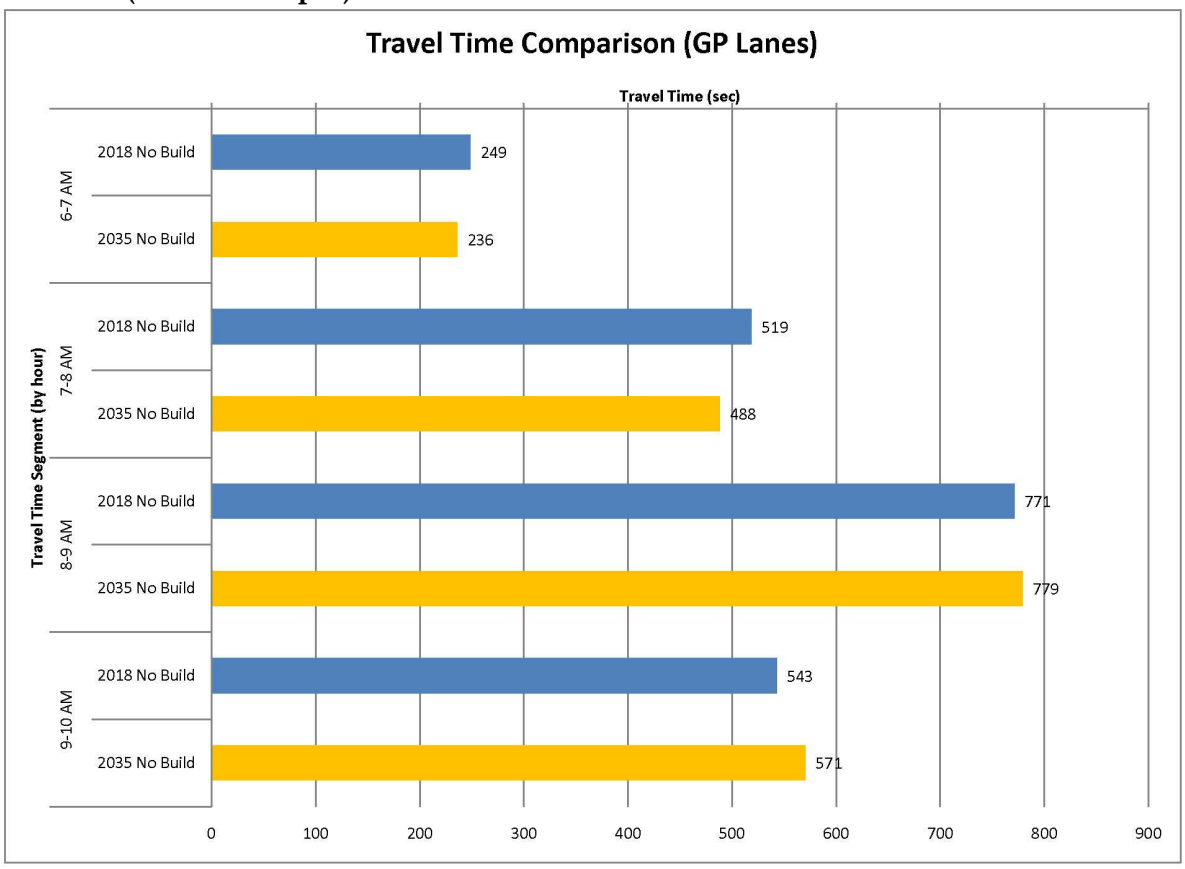
2035 No Build Scenario

Comparisons between the 2018 No Build and 2035 No Build scenarios are presented for travel time (**Exhibit 9-45**), temporal speed diagrams (**Exhibit 9-46**), and I-495 eastbound to I-395 northbound ramp queue length (**Exhibit 9-47**).

In the 2035 No Build scenario, the HOV lanes would continue to operate the same as the Existing and 2018 No Build scenarios. Demand for both GP and HOV lanes north of Duke Street for the 6:00-10:00 AM period is projected to increase by four percent when compared to 2018 No Build (as shown in **Table 9-41**). However, the 7:00-8:00 AM peak hour demand in the GP lanes north of Duke Street is only projected to increase by 1.5 percent. At the I-495 Springfield interchange, travel patterns shift between 2018 and 2035 No Build, with 4-hour demand on northbound I-395 decreasing eight percent while demand coming from the eastbound I-495 ramp increases 24 percent. **Exhibit 9-47** shows that this ramp is congested for much of the simulation period and would spill back onto the eastbound I-495 mainline for approximately two hours in the AM period, or at least 30 minutes longer than the 2018 No Build scenario. Constrained flow on this ramp allows the northbound I-395 GP lane travel time to be similar between 2018 No Build and 2035 No Build. However, when taking into account this

ramp and the impacts to the eastbound I-495 mainline, overall system impacts are slightly worse in 2035 No Build.

Exhibit 9-45: Northern Terminus – Travel time comparison between 2018 No Build and 2035 No Build (VISSIM output)



Note: Travel times measured from Springfield Interchange to the Northern Terminus (north of the Duke Street interchange).

Exhibit 9-46: Northern Terminus – Temporal speed diagram comparison between 2018 No Build and 2035 No Build (VISSIM output)

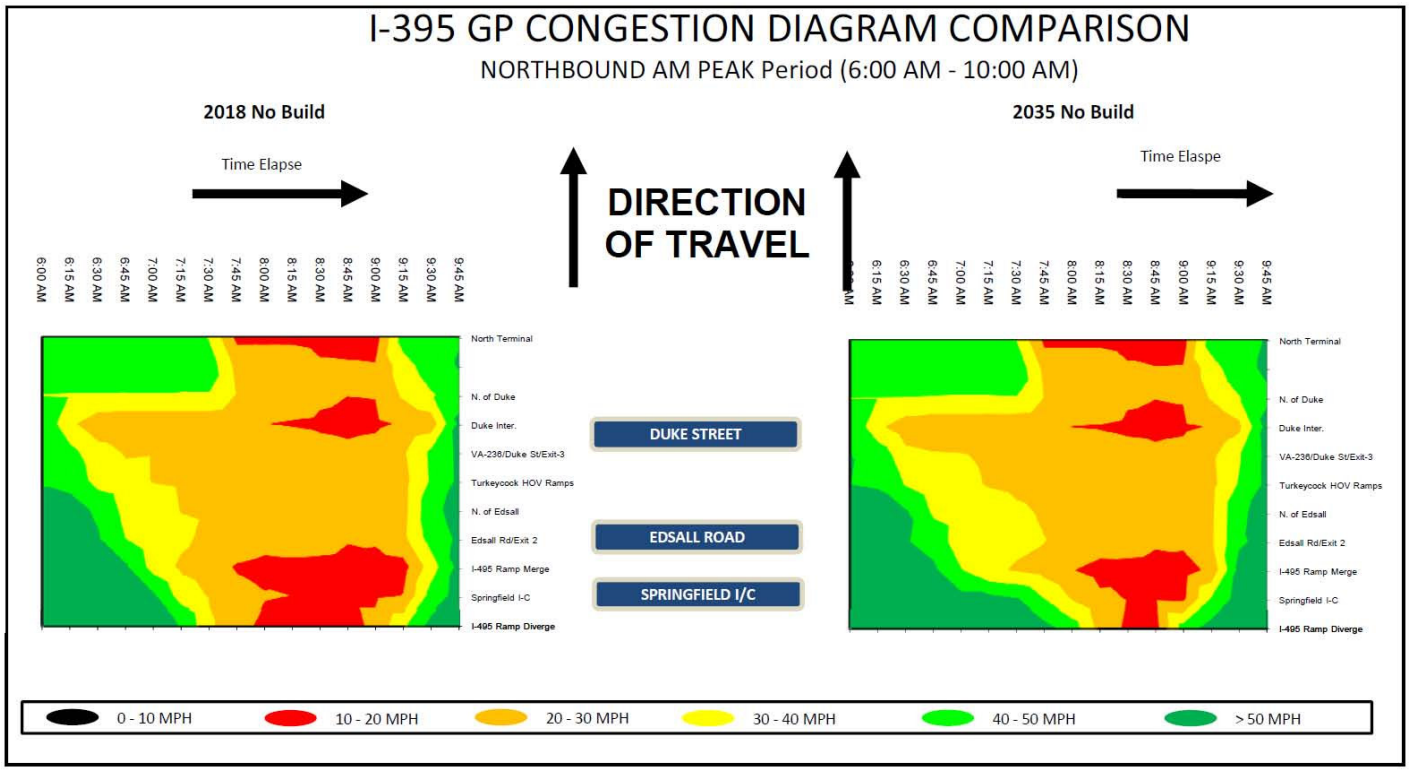
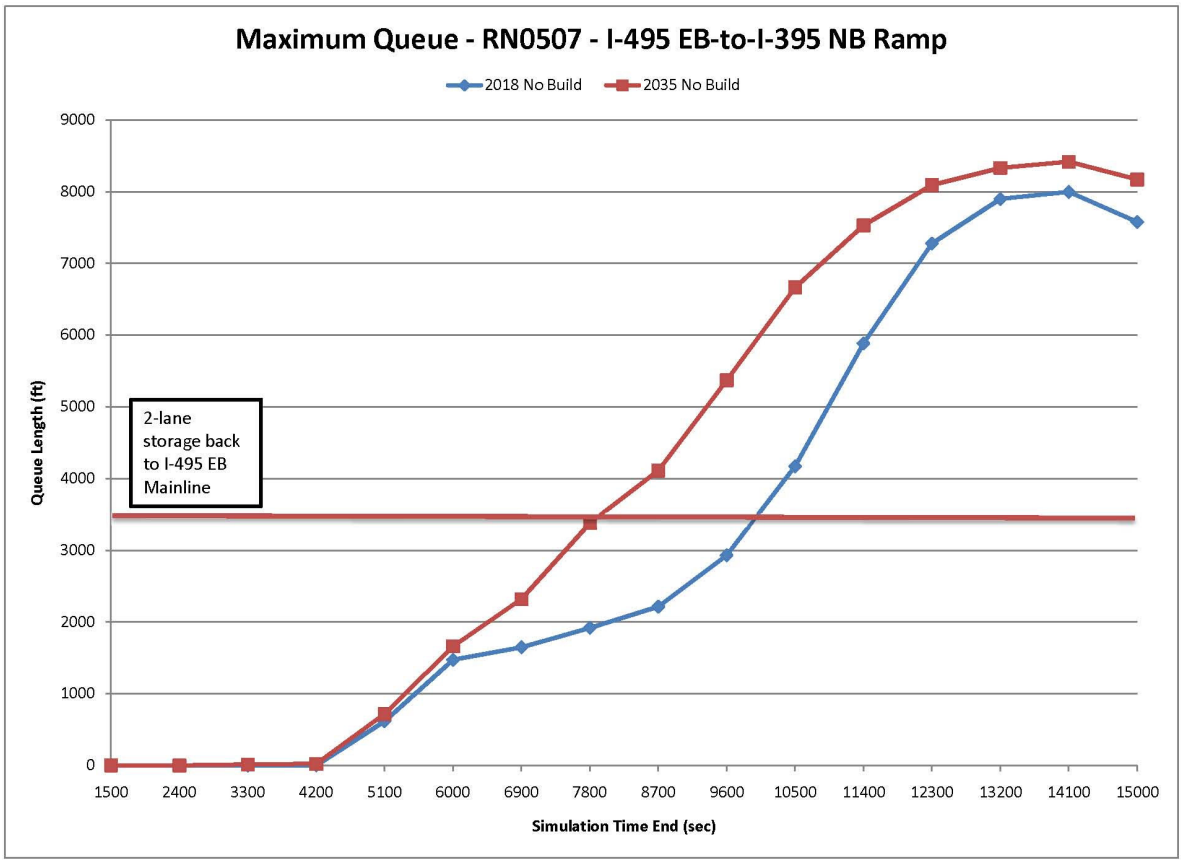


Exhibit 9-47: Northern Terminus – I-495 EB-to-I-395 NB ramp queue length comparison between 2018 No Build and 2035 No Build (VISSIM output)



2035 Build "Baseline" Scenario

In the 2035 Build "Baseline" scenario, the northbound I-95 HOV/HOT lane facility would be converted from an HOV3+ facility to a HOV/HOT facility, as described above in section 9.3.4.3.5 (2018 Build "Baseline" scenario). Exhibit 9-40 shows the proposed configuration of the Turkeycock HOT Flyover exit ramp.

The 2035 Build scenario traffic conditions are compared to the 2035 No Build scenario below for throughput volume on the northbound I-395 GP lanes north of Duke Street (**Exhibit 9-48**), travel time (**Exhibit 9-49**), temporal speed diagrams (**Exhibit 9-50**), and I-495 EB-to-I-395 NB ramp queue length (**Exhibit 9-51**).

Demand on northbound I-395, just north of Duke Street is projected to increase in the 2035 Build scenario by three percent over the 2035 No Build scenario. However, the capacity of the northbound I-395 GP lanes between Duke Street and Seminary Road will be the same between 2035 No Build and Build, as can be seen in the throughput volumes from Exhibit 9-48. In addition to slightly higher demand north of Duke Street, traffic patterns at the I-495 Springfield interchange shift between 2035 No Build and Build because of the HOT lane operations. The HOT Exit ramp at Turkeycock is projected to have 1,050 trips in the AM peak hour. These 1,050 trips that are entering the study area from the uncongested HOT lanes would have been

entering the study area from the northbound I-395 GP lanes in the No Build scenario. This shift in traffic pattern causes the GP lanes upstream of the Turkeycock HOT exit ramp to experience longer queues, slower speeds, and longer travel time in the 2035 Build "Baseline" scenario than the 2035 No Build scenario. Traffic conditions downstream of the Turkeycock HOT exit ramp are the same between the 2035 No Build and Build "Baseline" scenario.

Exhibit 9-48: Northern Terminus – Throughput volume comparison on I-395 NB GP Lanes north of Duke Street between 2035 No Build and 2035 Build "Baseline" (VISSIM output)

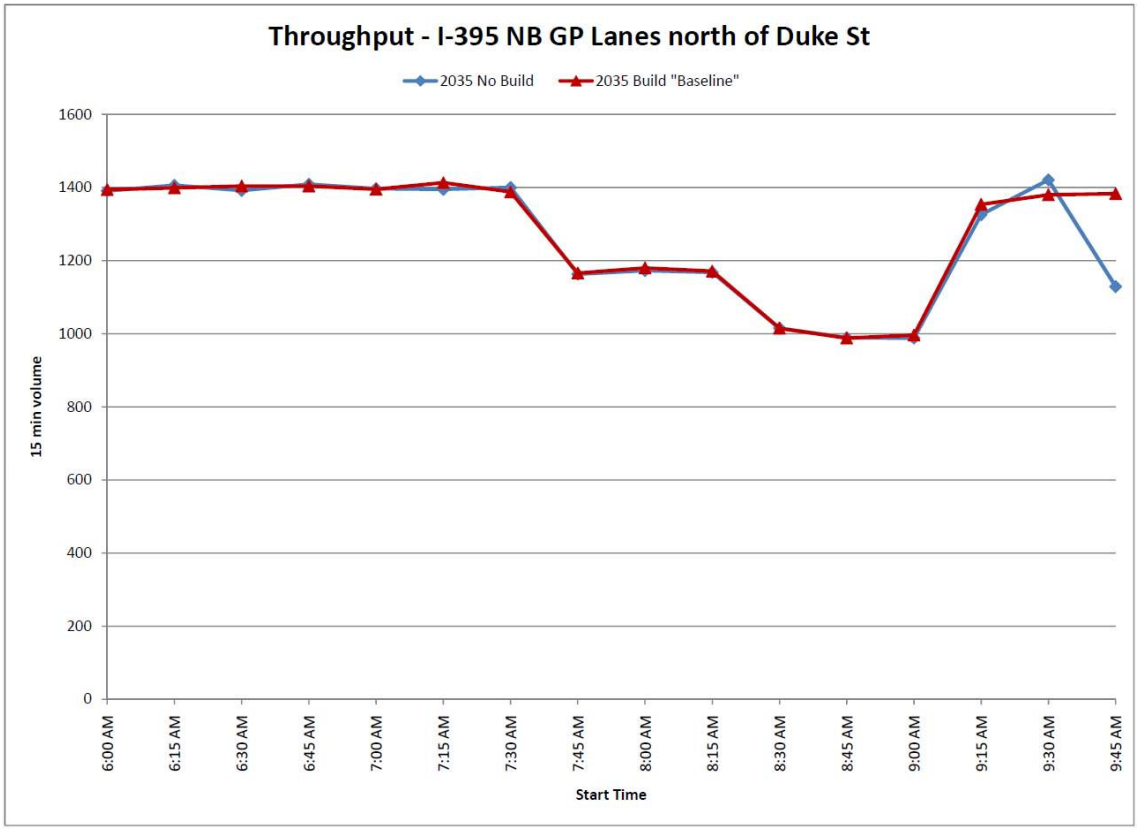
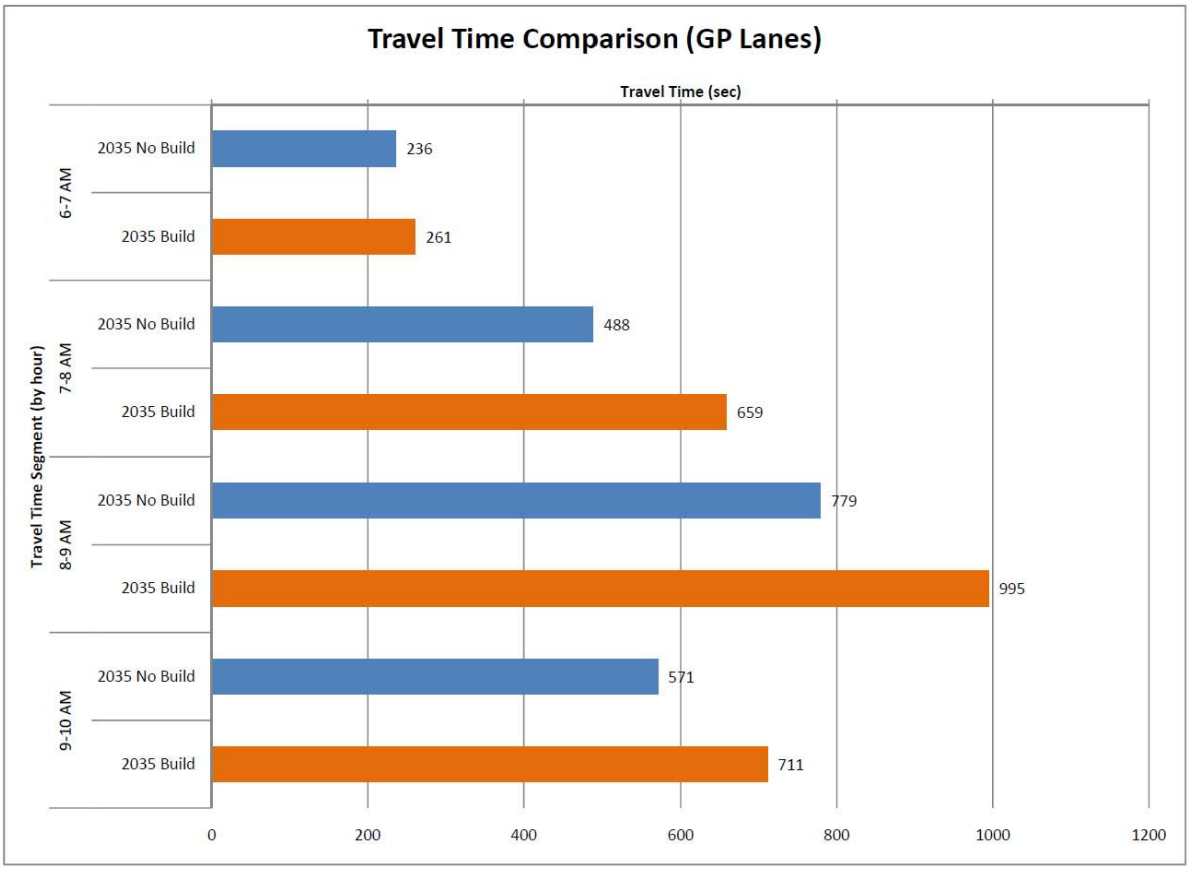
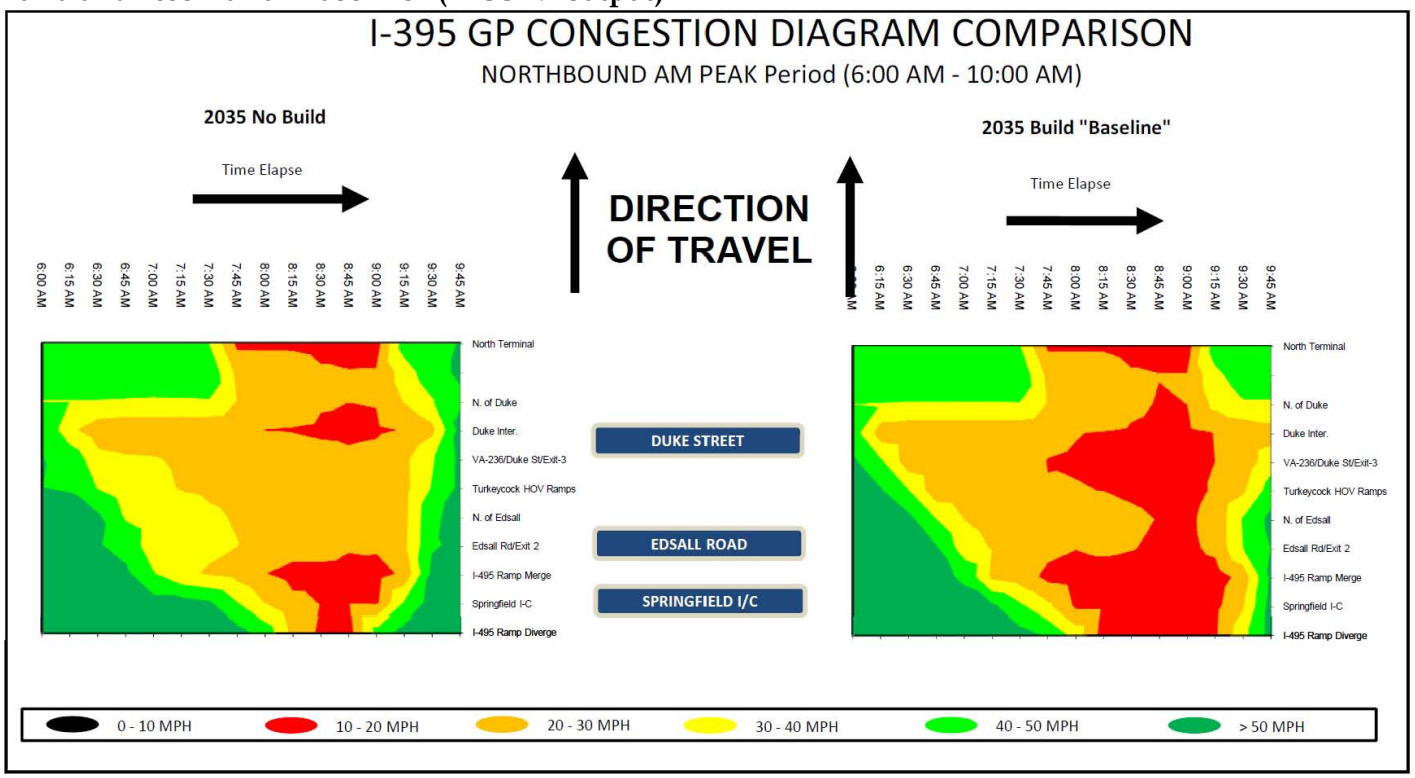


Exhibit 9-49: Northern Terminus – Travel time comparison between 2018 No Build and Build (VISSIM output)



Note: Travel times measured from Springfield Interchange to the Northern Terminus (north of the Duke Street interchange).

Exhibit 9-50: Northern Terminus – Temporal speed diagram comparison between 2035 No Build and 2035 Build "Baseline" (VISSIM output)



INTERSTATE 95 HOV/HOT LANES PROJECT

Commonwealth of Virginia

Virginia State Project Number 0095-96A-107, PE-101
UPC # 70849

Interchange Justification Report

Interstate Project

This document has been prepared and submitted pursuant to 23 U.S.C. 111 to obtain FHWA approval to add new access ramps/modify existing interchange ramps on a fully-controlled interstate highway.

Submitted November 2011 to:

United States Department of Transportation

Federal Highway Administration

Submitted by:

VDOT Virginia Department of Transportation

The request for reconfiguration of the interstate access points is approved for engineering and operational acceptability. This approval is conditional upon compliance with applicable federal requirements, specifically with the National Environmental Policy Act (NEPA). Completion of the NEPA process is considered acceptance of the general project location and concepts denoted in the environmental documentation.

For Irene Rico
Division Administrator
Federal Highway Administration, Virginia Division

12-19-11
Date of Approval

Malcolm T. Kerley, PE
Chief Engineer
Virginia Department of Transportation

12/15/11
Date of Approval

INTERSTATE 95 HOV/HOT LANES PROJECT

Commonwealth of Virginia

VIRGINIA MEGAPROJECTS

Interchange Justification Report

This document has been prepared to satisfy the requirements set forth by Federal and State Policy for changes in interstate access. It is consistent with the Virginia Department of Transportation's Location and Design Division Instructional and Informational Memorandum LD-200.4, and in accordance with the most recent update to FHWA's policy on *Access to the Interstate System* dated August 27, 2009.

Submitted November 2011 to:

United States Department of Transportation

Federal Highway Administration

Submitted by:

VDOT Virginia Department of Transportation

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Executive Summary

ES.1 Project Background

Interstate 95 (I-95) serves as a major corridor for the movement of people and freight along the entire eastern seaboard. It also serves as a regional route for commuters to and from the Washington, DC metropolitan area and is a local route for traffic in the suburban areas of the City of Fredericksburg and southeastern Fairfax County/ northeastern Prince William County. This segment of the I-95 corridor is one of the most congested freeways in the region and in the Commonwealth of Virginia, based on regular freeway operations / congestion surveys performed by both the local Metropolitan Planning Organization (the Metropolitan Washington Council of Governments, or MWCOG) and the Virginia Department of Transportation.

The existing I-95 mainline freeway has three general purpose (GP) lanes in each direction, from the south-most project terminus at the Garrisonville interchange to the Route 123 interchange (Exit 160). Between the Route 123 interchange and the Fairfax County Parkway interchange, I-95 was just recently expanded to four GP lanes in each direction, with additional lanes in each direction developed to the north up to the Capital Beltway (I-495). These basic through lanes are supplemented in a number of locations with acceleration/deceleration lanes at on and off-ramps and auxiliary lanes between interchanges.

The existing I-95 reversible High Occupancy Vehicle (HOV) facility through the study area is comprised of two lanes located in the center median, between the northbound and southbound GP lanes. The existing HOV lanes extend from Dumfries in Prince William County, just south of the Route 234 (Dumfries Road) interchange, to the Springfield Interchange at Interstate 495 (the Capital Beltway) /Interstate 395 in Fairfax County. North of the Capital Beltway, the reversible HOV lanes continue in the center median of Interstate 395 (I-395) through the City of Alexandria and Arlington County to the urban core of Washington, DC. [The mainline of I-95 makes a 90-degree turn at the Springfield Interchange and runs coincidental to I-495 around the eastern half of the Capital Beltway]. South of Dumfries to the southern terminus of the project at the interchange with Route 610 (Garrisonville Road) in Garrisonville, a distance of approximately 9 miles, there are currently no HOV lanes.

Under provisions of Virginia's Public-Private Transportation Act of 1995 (PPTA), the Virginia Department of Transportation (VDOT) and private partners Fluor Virginia, Inc. and Transurban USA, Inc. (Fluor-Transurban) propose to make the following changes along the I-95 corridor, as shown in **Figure ES-1**:

- Construct two new reversible HOV/HOT lanes along the 9-mile segment within the median between Route 610 (Garrisonville Road) and the existing terminus south of Route 234 (Dumfries Road);

- Convert the existing two-lane directional HOV facility to a two-lane reversible HOV/ High Occupancy Toll (HOT) lanes along a 6-mile segment between Route 234 (Dumfries Road) and Route 3000 (Prince William Parkway);
- Re-stripe and convert the existing two-lane directional HOV facility to a three-lane reversible HOV/ High Occupancy Toll (HOT) lanes along a 13.5-mile segment between Route 3000 (Prince William Parkway) and the Turkeycock ramps north of Edsall Road;
- Modify, upgrade and/or add new entry/exit points, including structures, between the GP lanes and the HOV/HOT lanes, and in a few isolated locations, to/from arterials.

ES.1.1 Project Termini

Several iterations of study limits and construction phasing have been proposed through the development history of this project over a number of years. The southernmost terminus proposed in the I-95 HOV/HOT Lanes Environmental Assessment (approved for Public Distribution by FHWA September 8, 2011) is located approximately 1.10 miles south of the U.S. Route 17 (Mills Drive) overpass near Massaponax. The proposed project study area in the NEPA documentation extends northward along existing I-95, and ends north of the I-395/Edsall Road interchange in Fairfax County. At the northern terminus, the transition to the existing I-395 HOV lanes and GP lanes is proposed just north of the I-395/Edsall Road interchange, at the existing Turkeycock ramp connections between the GP lanes and the HOV lanes south of the Alexandria City Limits.

Proposed improvements to the I-95 corridor, as part of the I-95 HOV/HOT Lanes project, will be constructed in two sections:

- Northern Section (Phase 1, 2015 opening year) – 40 miles from north of Garrisonville to south of Alexandria
- Southern Section (Phase 2, 2018 opening year) – 17 miles from south of Massaponax to north of Garrisonville

The Northern Section, or Phase 1 of the project, will include capacity expansion of the existing two-lane reversible HOV facilities in Fairfax County and portions in Prince William County to a three-lane reversible section between the Prince William Parkway and the Springfield Interchange. It will also include conversion of the reversible HOV facility to reversible HOT Lanes (HOV 3+ and toll-paying motorists). North of the Capital Beltway on I-395, the proposed HOT Lanes will transition back to HOV 3+ at the Turkeycock ramps, north of the Edsall Road interchange. All northbound HOT traffic will be directed to exit from the HOT lanes back into the GP lanes at a new flyover connection constructed at the Turkeycock ramps when the reversible lanes are flowing to the north. Conversely, southbound traffic will be able to enter the HOT lanes at the existing ramp connection between the GP lanes and the HOT lanes. Provision of additional ramp connections to and from the HOT Lanes, or ramp modifications to existing ramp connections within the corridor, will be included as a component of the Northern Section of the project. The Northern Section also includes construction of a nine-mile extension of the HOT lanes south

of the current barrier-separated HOV facility terminus at Route 234 in Dumfries, with an extension down to Garrisonville. **Figure ES-2** illustrates the configuration of the southern terminus to be constructed as part of the Northern Section (also known as the interim configuration of the southern terminus). Construction of the Northern Section is anticipated to commence in 2012 and last approximately three years, with an opening year of 2015 or 2016.

This Interchange Justification Report (IJR) is being prepared for the Northern Section of the project (Phase 1) only, with a southern terminus proposed just north of Route 610 Garrisonville Road. A separate IJR will be produced for the southern section (Phase 2) between Massaponax and Garrisonville at a later date. These project limits for the IJR extend approximately 40 miles, affect 23 interchanges and lie within Stafford County, Prince William County, the Town of Dumfries, Fairfax County, and the southern edge of the City of Alexandria.

The Southern Section (Phase 2) of the I-95 HOV/HOT Lanes project would extend the two-lane reversible HOT lanes for another 17 additional miles, from Garrisonville down to Massaponax, and include additional slip ramps and access points. **Figure ES-3** illustrates the configuration of the southern terminus to be constructed as part of the Southern Section (also known as the final configuration of the southern terminus). Construction would begin within the next few years, with an anticipated opening date of 2018. The complete system is anticipated to be fully operational by 2018 for the entire 57-mile corridor.

ES.1.2 Summary of Project Purpose and Need

The purpose of the project is to expand highway capacity while also facilitating ridesharing and transit choices by providing dedicated lanes for multi-occupant vehicles. One of the objectives of the expansion and conversion of the HOV system to HOV/HOT is to be able to realize underutilized capacity on the existing HOV lanes while reducing congestion on the sections of the GP lanes that currently operate over capacity and that will continue to be oversaturated in the future.

ES.2 Summary of Proposed Action

Under the proposed action for this IJR, the Northern Section of the I-95 HOV/HOT Lanes proposes the following improvements to the I-95 corridor:

- Extend the new HOV/HOT lane facility approximately 9 miles to the south by constructing two lanes in the median of I-95 between Garrisonville in Stafford County and the existing southern terminus at Dumfries in Prince William County;
- Convert the existing two-lane HOV facility, from south of Dumfries to north of Prince William Parkway, to a two-lane HOV/HOT lane facility;
- Expand the current two-lane HOV facility, between the Prince William Parkway and the northern terminus (located approximately 2 miles north of Capital Beltway near Turkeycock Run), to a three-lane HOV/HOT lane facility;

- Add new entry/exit points into and out of the lanes.

New entry/exit points into and out of the HOV/HOT lanes, as listed in **Table ES-1** Modifications in Access below, will be added along the corridor. All existing entry/exit points between 2 miles north of I-495 (including Turkeycock Run southbound HOV ramp) and south of the Town of Dumfries will be converted to HOV/HOT unless modified as indentified below.

Table ES-1. Modifications in Access

No.	Route	Connection Location:	Morning Connections	Evening Connections	Type of Modification
1	I - 95	Between VA 619 (Joplin Road) and VA 610 (Garrisonville Road)	NB general purpose lanes to NB HOV/HOT lanes	SB HOV/HOT Lanes to SB general purpose lanes	New – NB slip ramp and SB flyover
2	I - 95	Between US 234 (Dumfries Road) and VA 619 (Joplin Road)	N/A	SB HOV/HOT Lanes to SB general purpose lanes	Expanded – replace SB slip ramp with flyover
3	I - 95	Between Opitz and Dale Blvd	N/A	SB GP to SB HOV/HOT Lanes	New
4	I - 95	Between VA 123 (Gordon Road) and VA 3000 (Prince William County Parkway)	NB HOV/HOT Lanes to NB general purpose lanes	N/A	New
5	I - 95	Between VA 642 (Lorton Road) and Rt 1	N/A	SB GP to SB HOV/HOT Lanes	New
6	I - 95	Between VA 7100 (Fairfax County Pkwy) and VA 638 (Pohick Road)	N/A	SB HOV/HOT Lanes to SB general purpose lanes	Ramp Deleted (to accommodate No. 2 above)
7	I - 95	VA 7100 (Fairfax County Parkway) via Alban Rd / Doudinot Dr	NB HOV/HOT Lanes to Fairfax County Parkway (via Alban Rd / Boudinot Dr)	Fairfax County Parkway (via Alban Rd / Boudinot Dr) to SB HOV/HOT Lanes	New (*REVERSIBLE*)
8	I - 395	Between VA 648 (Edsall Road) and Turkeycock Run	NB HOV/HOT Lanes to NB general purpose lanes	N/A	New

With the exception of the following locations, at-grade slip ramps would enable access between the GP and HOT lanes:

- Between Garisonville Road and Russell Road and between Joplin Road and Dumfries Road, flyovers would be constructed to enable traffic to exit the HOV/HOT lanes and enter the right-hand southbound GP lane.

- A reversible flyover would be constructed to provide direct access between Alban Road and the HOV/HOT lanes.
- At the northern terminus of the project (north of Edsall Road), a flyover would be constructed to enable traffic to exit the HOV/HOT lanes and enter the right-hand northbound GP lane.

Other infrastructure elements associated with the project would include signage, electronic variable message displays, electronic toll collection equipment, reversible traffic control gates, sound barrier walls and stormwater management facilities.

ES.3 Summary of Findings

The operational and safety analysis performed as part of the access request includes the GP mainline and reversible HOV or HOT freeway segments, associated ramps and C-D roads for the length of the project, plus the first adjacent interchange on each side of the proposed HOT Lanes termini for the Northern Project. At each of the interchanges, the crossroads included the ramp terminal intersections and adjacent local street intersections (within close proximity). At the Capital Beltway and at the Springfield-Franconia Parkway, the next adjacent interchanges on either side of I-95 were also included in the analysis.

The proposed plan should produce marked operational improvements to the overall system by increasing capacity and access on the reversible lanes and by transferring some of the traffic currently using the over-saturated GP Lanes to the proposed HOT Lanes, which operate with excess capacity if they are left to remain as operating under HOV-3+ only. The analysis using traffic simulation showed improvements in travel times, throughput, speeds, and congestion/queuing on a number of segments within the GP Lanes, without adversely impacting those same elements on the HOT Lanes. A detailed assessment of traffic operations using microsimulation (VISSIM) and deterministic methods (Highway Capacity Software HCS-2010) is presented in Chapter 9 of this document.

ES.3.1 Operational Analysis Findings

Traffic operational analyses and quantitative safety studies consistent with FHWA's policy are documented herein. The preliminary 2018 and 2035 traffic operational analyses do not show marked degradation between the No-Build and Build conditions. One exception is during the AM peak period at the northern terminus of the project, in the GP Lanes from Edsall Road to north of Duke Street. In both 2018 and 2035, the operations show some degradation of operations on the GP Lanes due to the proposed change in capacity of the HOT Lanes north of Edsall Road (transition from 3 lanes to 2 lanes) and transition of toll-paying traffic back to the GP lanes.

A major contributing element to operations at the northern terminus which occurs in the Existing, No-Build and Build scenarios is the downstream congestion and queuing resulting from operations at Seminary Road interchange and the northbound freeway segment between Duke Street and Seminary Road. However, the proposed plan was also assessed with a sensitivity analysis which identified some downstream improvements that could be implemented at some point as a separate project, as deemed appropriate by FHWA and VDOT, to mitigate traffic operational or safety issues resulting from the existing spillback. A

detailed discussion on mitigation for the northern terminus in Section 9.3 of this IJR provides a range of options to address the issues specific to the northbound traffic at the northern terminus mentioned above. This mitigation is focused on addressing potential traffic operational issues that could be associated with downstream conditions such that the proposed project can be implemented without adverse impacts to adjacent interchange and arterials.

A similar issue was observed under a "Phase 1 interim conditions" sensitivity analysis at the southern terminus for the Northern Section, for the 2018 horizon year only, assuming that all southbound HOT/HOV traffic must exit the reversible lanes and transition back to the GP Lanes at Garrisonville. This scenario is limited to the PM peak period in the near term, up until such time that the Southern Project is completed and HOT/HOV traffic may continue south on the new HOT Lanes beyond Garrisonville and down to Massaponax (southern terminus for the Southern Section). Sensitivity analyses for this location show that bottle-neck congestion may be mitigated through the use of dynamic tolling on the south-most tolling segment, and that the total travel time and vehicle throughput improve for the Build Scenario. The analysis and results are discussed in detail in Section 9.3.

Supporting documentation also includes a functional signing plan (Appendix G) and assumptions used in developing a signing concept, as provided in Section 13 of this document.

ES.3.2 Crash Analysis Findings

From 2006 to 2008, there were 5,948 reported crashes along I-95/395 from south of Garrisonville Road to north of Duke Street. There were also 892 reported crashes along I-495 from north of Braddock Road to east of Van Dorn Street. Several exhibits were prepared to summarize the crash history for the mainline corridor (I-95/395) by freeway direction and analysis segments. Graphics included in the detailed Crash Analysis Chapter show the total number of study area crashes by location and severity for the northbound and southbound GP lanes respectively, as well as the total number of study area crashes by location and collision type for each travel direction.

Crashes peak between Gordon Boulevard and Fairfax County Parkway. It should be noted that the proportion of rear end crashes greatly increases at the northern end of the corridor. Overall, rear end (including sideswipe-same direction) plus lane departure (including fixed object crashes and non collisions) collisions account for over 95 percent of all crashes in the GP lanes. In the southern half of the corridor, approximately 60 percent of all crashes were rear end. However, in the northern half, rear end crashes represented nearly 80 percent of all collisions. Inspection of the data reveals that the crash increases seen in the northern corridor are predominately a result of growth in rear end crashes. This trend is expected to be directly related to existing congestion and degraded traffic operations that are concentrated around Gordon Boulevard and at the northern end of the corridor. The expectation is that higher volumes along with more frequent stop and go traffic operations result in more conflicts and related rear end collisions.

Overall it can be concluded that the preferred design should not have significant adverse impacts on the safety of the freeway systems within the study area. Rather, with the

proposed project and balancing of traffic flow and congestion within the corridor, it is expected that the anticipated operations improvements will have a positive effect on the corridor's safety performance, such that the built corridor may be better than, and certainly no worse than, the no-build condition. While the safety performance review of the corridor indicates that crash frequency may increase at the points of new connections with the freeway facility, the improvement of traffic operations along the corridor, especially the northern half of the study corridor should have an overall positive effect on safety, thus reducing crash rates along the mainline sections. Though crashes may increase on the reversible lanes, the cumulative effect of this project on the safety of the corridor will be a positive impact.

ES.4 Conclusions

VDOT and private partners Fluor-Transurban have developed a design solution to resolve the issues raised in the Purpose and Need Statement for the I-95 HOV/HOT Lanes project, as documented in the EA prepared for the project. Throughout the entire project development process for the improvements proposed in this IJR, VDOT and Fluor-Transurban have worked in partnership to advance engineering and analysis in support of the proposed improvements. The Preferred Alternative has no significant impacts on the operations and safety of I-95 (i.e. no major degradation between No-Build and Build scenarios), and does not preclude implementation of an ultimate long range plan for the I-95 corridor.

This report demonstrates that the Preferred Alternative is consistent with eight policy points under FHWA's *Policy on Access to the Interstate System*. VDOT supports this Preferred Alternative as addressing the fundamental issues and concerns presented in this document and in the EA, and formally requests that FHWA find this plan to be geometrically and operationally acceptable.

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All Figures and Appendices are contained in separate volumes that serve as companion documents to this report.